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A

KEY

TO THE

NATIONAL ARITHMETIC,

EXHIBITING THE OPERATION OF

THE MORE DIFFICULT QUESTIONS

IN THAT WORK;

FOR THE USE OF TEACHERS ONLY.

BY BENJAMIN GREENLEAF, A. M.
LATE PRECEPTOR OF BRADFORD ACADEMY.

BOSTON:
PUBLISHED BY ROBERT S. DAVIS,
AND
GOULD, KENDALL, AND LINCOLN.

1837.

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THE object of the author, in this publication, is to aid the teacher in communicating his instructions to his pupils, and enable him the more readily to detect any error, which they may have made in the operation of their questions.

Every instructor, who has a large number of scholars under his care, is aware of the fact, that it is a great tax on his time, especially when in school, to examine the operation of many questions of his students; whereas, by the aid of a Key, he may be able, in a few moments, to detect any mistake in the operation, and thereby save much of his time, which may be devoted to more useful purposes. Besides, in the hurry of business, it is often very difficult for the most able arithmetician to recollect, at the moment, all the principles by which some difficult questions are performed; but, by recurring to a Key, his difficulty will be obviated.

The author would recommend the following maxim to every teacher:—Never give a pupil a direct answer to any question he may propose respecting the operation of any problem, nor perform the labor for him, but suggest such principles as will enable him to perform the question himself.

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INDEX.

	Page.
Compound Addition	5
Compound Subtraction	6
Reduction Descending	"
Reduction Ascending	8
Compound Reduction	11
Vulgar Fractions	13
Addition of Vulgar Fractions	17
Subtraction of Vulgar Fractions	19
Addition of Decimals	20
Subtraction of Decimals	21
Circulating Decimals	22
Addition of Circulating Decimals	23
Subtraction of Circulating Decimals	24
Multiplication of Circulating Decimals	25
Division of Circulating Decimals	26
Partial Payments	"
Miscellaneous Problems	35
Miscellaneous Questions	"
Discount	"
Commission and Brokerage	37
Stocks	38
Insurance and Policies	"
Banking	39
Barter	"
Compound Interest	40
Practice	41
Equation of Payments	46
American Duties	50
Proportion	51
Compound Proportion	61
Chain Rule	62
Company Business, or Fellowship	64
Partnership on Time, or Double Fellowship	68
Loss and Gain	73
Duodecimals	75
Square Root	78
Cube Root	80
Arithmetical Progression	81
Geometrical Series	82
Infinite Series	83
Discount by Compound Interest	84
Annuities at Compound Interest	"
Alligation	86
Permutations and Combinations	88
Single Position	89
Double Position	90
Geometry	92
Tonnage of Vessels	95
Mensuration of Lumber	96
Philosophical Problems	"
Mechanical Powers	98
Specific Gravity	99
Astronomical Problems	100
Miscellaneous Questions	"

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KEY

TO

GREENLEAF'S ARITHMETIC

SECTION VI.

COMPOUND ADDITION.

2. (p. 40.) $177.66.3.
3. $2877.87.2.
5. 141£. 10s. 7¾d.
6. 161£. 17s. 7d.
8. 385lb. 7oz. 5dwt. 10gr.
10. 246℔. 10ʒ. 3ȝ. 2ϑ. 2gr.
12. 233cwt. 1qr. 6lb. 4oz. 5dr.
14. 317m. 3fur. 18rd. 4yd. 2ft. 6in. 0br.
16. 2513EE. 3qr. 2na. 0in.
18. 317A. 0R. 24p. 13¾ft.
20. 378 cords, 96ft. 1460in.
22. 286hhd. 42gal. 1qt. 1pt.
24. 784hhd. 24gal. 2qt. 0pt.
26. 240ch. 20bu. 2pk. 7qt.
28. 212y. 11m. 29d. 4h.
30. 11S. 2°. 22′. 42″.
32. 194m. 6fur. 9ch. 0p. 12li.

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COMPOUND SUBTRACTION.

2. (p. 44.) $491.72.9.
4. 435£. 15s. 9½d.
6. 38lb. 7oz. 14dwt. 13gr.
8. 5℔. 5ʒ. 0ʒ. 1℈. 17gr.
10. 53cwt. 3qr. 23lb. 14oz.
12. 31EE. 4qr. 2na.
14. 9deg. 4m. 5fur. 37rd. 4yd. 1ft. 4in. 1br.
16. 3A. 1R. 38p. 18yd. 7ft. 34in.
18. 163 cords, 53ft. 1289in.
20. 6hhd. 61gal. 2qt. 1pt.
22. 577hhd. 52gal. 2qt.
24. 26ch. 22bu. 2pk. 4qt.
26. 28y. 12m. 2w. 4d. 21h. 48m. 35sec.
28. 2S. 27°. 21′. 54″.
30. 12m. 6fur. 8ch. 0p. 24li.

SECTION VII.

REDUCTION DESCENDING.

2. (p. 52.) $127 \times 20 + 15 = 2555 \times 12 + 8 = 30668 \times 4 = 122672$ Ans.

3. $28 \times 20 + 19 = 579 \times 12 + 11 = 6959 \times 4 + 3 = 27839$ Ans.

4. $378 \times 20 = 7560 \times 12 = 90720$ Ans.

5. $28 \times 12 + 11 = 347 \times 20 + 12 = 6952 \times 24 + 15 = 166863$ Ans.

6. $17 \times 12 = 204 \times 20 + 12 = 4092$ Ans.

7. $3 \times 12 + 11 = 47 \times 20 = 940 \times 24 = 22560$ Ans.

8. $23 \times 12 = 276 \times 8 = 2208 \times 3 = 6624$ Ans.

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9. $3 \times 20 + 16 = 76 \times 4 + 2 = 306 \times 28 + 18 = 8586 \times 16 = 137376$ Ans.

10. $2 \times 20 + 17 = 57 \times 4 + 3 = 231 \times 28 + 16 = 6484 \times 16 + 15 = 103759 \times 16 + 13 = 1660157$ Ans.

11. $57 \times 4 = 228 \times 4 = 912$ Ans.

12. $83947 \times 5 + 4 = 419739 \times 4 = 1678956$ Ans.

13. $2263 \times 3 + 2 = 6791$ Ans.

14. $79 \times 8 = 632 \times 40 = 25280 \times 16\frac{1}{2} = 417120$ Ans.

15. $396 \times 40 = 15840 \times 16\frac{1}{2} = 261360 \times 12 = 3136320$ Ans.

16. $30 \times 8 = 240 \times 40 = 9600 \times 16\frac{1}{2} = 158400 \times 12 = 1900800$ Ans.

17. $360 \times 69\frac{1}{2} = 25020 \times 8 = 200160 \times 40 = 8006400 \times 16\frac{1}{2} = 132105600 \times 12 = 1585267200 \times 3 = 4755801600$ Ans.

18. $403 \times 8 + 7 = 3231 \times 40 + 35 = 129275 \times 5\frac{1}{2} + 2 = 711014\frac{1}{2} \times 3 = 2133043\frac{1}{2} \times 12 = 25596522 \times 3 + 1 = 76789567$ Ans.

19. $413 \times 3 + 2 = 1241 \times 8 + 2 = 9930 \times 40 + 38 = 397238 \times 5\frac{1}{2} + 1 = 2184810 \times 3 = 6554430 \times 12 + 1 = 78653167$ Ans.

20. $144 \times 8 + 1 = 1153 \times 40 + 8 = 46128 \times 5\frac{1}{2} + 1 = 253705 \times 3 + 1 = 761116$ Ans.

21. $1051 \times 3 + 2 = 3155 \times 12 + 5 = 37865$ Ans.

22. $3576 \times 40 + 12 = 143052 \times 5\frac{1}{2} + 3 = 786789$ Ans.

23. $25 \times 160 = 4000 \times 272\frac{1}{4} = 1089000$ Ans.

24. $365 \times 640 = 233600 \times 160 = 37376000$ Ans.

25. $196563942 \times 640 = 125800922880 \times 160 = 20128147660800 \times 272\frac{1}{4} = 5479888200652800 \times 144 = 789,103,900,894,003,200$ Ans.

26. $10 \times 4 + 3 = 43 \times 40 + 38 = 1758 \times 30\frac{1}{4} + 6 = 53185\frac{1}{2} \times 9 + 5 = 478674\frac{1}{2} + 72$in. or $\frac{1}{2}$ft. $= 478675$ Ans.

27. $2 \times 40 = 80 \times 30\frac{1}{4} + 24 = 2444 \times 9 + 3 = 21999 \times 144 = 3167856$ Ans.

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28. $1 \times 4 + 3 = 7 \times 40 + 34 = 314 \times 30\frac{1}{4} + 27 = 9525\frac{1}{2} \times 9 + 4 = 85733\frac{1}{2} \times 144 + 54 = 12345678$ Ans.

29. $17 \times 128 = 2176 \times 1728 = 3760128$ Ans.

30. $19 \times 40 = 760 \times 1728 = 1313280$ Ans.

31. $128 \times 128 = 16384$ Ans.

32. $4899 \times 63 + 4 = 308641 \times 4 + 3 = 1234567$ Ans.

33. $1224 \times 2 + 1 = 2449 \times 2 + 1 = 4899 \times 63 + 19 = 308656 \times 4 + 1 = 1234625 \times 2 = 2469250 \times 4 + 1 = 9877001$ Ans.

34. $790 \times 2 = 1580 \times 63 + 58 = 99598 \times 4 = 398392 \times 2 + 1 = 796785$ Ans.

35. $460 \times 2 + 1 = 921 \times 54 + 31 = 49765$ Ans.

36. $36 \times 54 + 26 = 1970 \times 4 + 3 = 7883 \times 2 + 1 = 15767$ Ans.

37. $16 \times 40 = 640 \times 1728 = 1105920$ Ans.

38. $365\frac{1}{4} \times 24 = 8766 \times 60 = 525960 \times 60 = 31557600$; $2348 + 1835 = 4183 \times 31557600 = 132005440800$ Ans.

39. June 13 + July 31 + August 31 + September 30 + October 31 + November 30 + December 31 + January 31 + February 16 + 365 + 365 = 974 days, Ans.

40. $676 \times 36 = 24336 \times 4 = 97344$ pecks, Ans.

41. $657 \times 10 = 6570$ mills, Ans.

42. $3165 \times 100 = 316500$ mills, Ans.

43. $63 \times 100 = 6300$ cents, Ans.

44. $27 \times 10 \times 100 \times 10 = 270000$ mills, Ans.

REDUCTION ASCENDING.

2. (p. 54.) $122672 \div 4 = 30668$d. $\div 12 = 2555$s. 8d. $\div 20 = 127$£. 15s. 8d. Ans.

3. $27839 \div 4 = 6959\frac{3}{4}$d. $\div 12 = 579$s. 11d. $\div 20 = 28$£. 19s. $11\frac{3}{4}$d. Ans.

4. $90720 \div 12 = 7560$s. $\div 20 = 378$£. Ans.

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5. 166863 ÷ 24 = 6952dwt. 15gr. ÷ 20 = 347oz. 12dwt. ÷ 12 = 28lb. 11oz. 12dwt. 15gr. Ans.

6. 4092dwt. ÷ 20 = 204oz. 12dwt. ÷ 12 = 17lb. 0oz. 12dwt. Ans.

7. 22560 ÷ 24 = 940dwt. ÷ 20 = 47oz. ÷ 12 = 3lb. 11oz. Ans.

8. 6624 ÷ 3 = 2208ʒ. ÷ 8 = 276ʒ. ÷ 12 = 23℔. Ans.

9. 137376 ÷ 16 = 8586lb. ÷ 28 = 306qr. 18lb. ÷ 4 = 76cwt. 2qr. ÷ 20 = 3 tons, 16cwt. 2qr. 18lb. Ans.

10. 1660157 ÷ 16 = 103759oz. 13dr. ÷ 16 = 6484lb. 15oz. ÷ 28 = 231qr. 16lb. ÷ 4 = 57cwt. 3qr. ÷ 20 = 2T. 17cwt. 3qr. 16lb. 15oz. 13dr. Ans.

11. 912 ÷ 4 = 228qr. ÷ 4 = 57yd. Ans.

12. 1678956 ÷ 4 = 419739gr. ÷ 5 = 83947EE. 4qr. Ans.

13. 6791 ÷ 3 = 2263EF. 2qr. Ans.

14. 417120 ÷ 16½ = 25280rd. ÷ 40 = 632fur. ÷ 8 = 79m. Ans.

15. 3136320 ÷ 12 = 261360ft. ÷ 16½ = 15840rd. ÷ 40 = 396fur. Ans.

16. 1900800 ÷ 12 = 158400ft. ÷ 16½ = 9600rd. ÷ 40 = 240fur. ÷ 8 = 30m. Ans.

17. 4755801600 ÷ 3 = 1585267200in. ÷ 12 = 132105600ft. ÷ 16½ = 8006400rd. ÷ 40 = 200160fur. ÷ 8 = 25020m. ÷ 69½ = 360deg. Ans.

18. 76789567 ÷ 3 = 25596522in. 1br. ÷ 12 = 2133043ft. 6in. ÷ 3 = 711014yd. 1ft. ÷ 5½ = 129275rd. 1½yd. ÷ 40 = 3231fur. 35rd. ÷ 8 =

403m. 7fur. 35rd. 1½yd.	1ft. 6in. 1br.
	½yd. = 1ft. 6in. 0br.
403m. 7fur. 35rd. 2yd.	0ft. 0in. 1br. Ans.

19. 78653167 ÷ 12 = 6554430ft. 7in. ÷ 3 = 2184810yd. ÷ 5½ = 397238rd. 1yd. ÷ 40 = 9930fur. 38rd. ÷ 8 = 1241m. 2fur. ÷ 3 = 413L. 2m. 2fur. 38rd. 1yd. 0ft. 7in. Ans.

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20. 761116 ÷ 3 = 253705yd. 1ft. ÷ 5½ = 46128rd. 1yd. ÷ 40 = 1153fur. 8rd. ÷ 8 = 144m. 1fur. 8rd. 1yd. 1ft. Ans.

21. 37865 ÷ 12 = 3155ft. 5in. ÷ 3 = 1051yd. 2ft. Ans.

22. 786789 ÷ 5½ = 143052rd. 3yd. ÷ 40 = 3576fur. 12rd. 3yd. Ans.

23. 1089000 ÷ 272¼ = 4000rd. ÷ 160 = 25A. Ans.

24. 37376000 ÷ 160 = 233600A. ÷ 640 = 365 square miles, Ans.

25. 789,103,900,894,003,200 ÷ 144 = 5479888200652-800ft. ÷ 272¼ = 20128147660800rd. ÷ 160 = 125800922880A. ÷ 640 = 196563942 square miles, Ans.

26. 478675 ÷ 9 = 53186yd. 1ft. ÷ 30¼ = 1758rd. 6½yd. ÷ 40 = 43R. 38rd. ÷ 4 =

10A. 3R. 38rd. 6½yd. 1ft.
½yd. = 4ft. 72in.

10A. 3R. 38rd. 6yd. 5ft. 72in. Ans.

27. 3167856 ÷ 144 = 21999ft. ÷ 9 = 2444yd. 3ft. ÷ 30¼ = 80rd. 24yd. ÷ 40 = 2R. 0rd. 24yd. 3ft. Ans.

28. 12345678 ÷ 144 = 85733ft. 126in. ÷ 9 = 9525yd. 8ft. ÷ 30¼ = 314p. 26½yd. ÷ 40 = 7R. 34p. ÷ 4 =

1A. 3R. 34p. 26½yd. 8ft. 126in.
½yd. = 4ft. 72in.

1A. 3R. 34p. 27yd. 4ft. 54in. Ans.

29. 3760128 ÷ 1728 = 2176ft. ÷ 128 = 17 cords, Ans.

30. 1313280 ÷ 1728 = 760ft. ÷ 40 = 19 tons, Ans.

31. 16384 ÷ 128 = 128 cords, Ans.

32. 1234567 ÷ 4 = 308641gal. 3qt. ÷ 63 = 4899hhd. 4gal. 3qt. Ans.

33. 9877001 ÷ 4 = 2469250pt. 1gi. ÷ 2 = 1234625qt. ÷ 4 = 308656gal. 1qt. ÷ 63 = 4899hhd. 19gal. ÷ 2 = 2449pi. 1hhd. ÷ 2 = 1224T. 1pi. 1hhd. 19gal. 1qt. 0pt. 1gi. Ans.

34. 796785 ÷ 2 = 398392qt. 1pt. ÷ 4 = 99598qt. ÷ 63

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= 1580hhd. 58gal. ÷ 2 = 790pi. 0hhd. 58gal. 0qt. 1pt. Ans.

35. 49765 ÷ 54 = 921hhd. 31gal. ÷ 2 = 460 butts, 1hhd. 31gal. Ans.

36. 15767 ÷ 2 = 7883qt. 1pt. ÷ 4 = 1970gal. 3qt. ÷ 54 = 36hhd. 26gal. 3qt. 1pt. Ans.

37. 1105920 ÷ 1728 = 640ft. ÷ 40 = 16 tons, Ans.

38. 132005440800 ÷ 60 = 2200090680m. ÷ 60 = 36668178h. ÷ 24 = 1527840$\frac{3}{4}$ days, ÷ 365$\frac{1}{4}$ = 4183 years.

39. 974 ÷ 365 = 2 years, 244 days, Ans.

40. 97344 ÷ 4 = 24336bu. ÷ 36 = 676chald. Ans.

41. 6570 ÷ 10 = 657 cents, Ans.

42. 316500 ÷ 100 = 3165 dimes, Ans.

43. 6300 ÷ 100 = $63 Ans.

44. 270000 ÷ 10 = 27000 cts. ÷ 100 = $270 ÷ 10 = 27 Eag. Ans.

COMPOUND REDUCTION.

1. (p. 55.) 57£. 15s. = 1155s. ÷ 6 = $192.50.

2. 67£. 14s. 9d. = 16257d.; 6s. 7d. = 79d.; 16257 ÷ 79 = 205cr. 62d. = 5s. 2d. Ans.

3. $678 × 6 = 4068s. ÷ 20 = 203£. 8s. Ans.

4. 761 × 4 = 3044qr. ÷ 5 = 608EE. 4qr. Ans.

5. 61 × 3 = 183qr. ÷ 4 = 45yd. 3qr. Ans.

6. 63 × 4 = 252 × 2 = 504 ÷ 3 = 168 bottles, Ans.

7. 15 × 1760 = 26400yd. × 3 = 79200ft. × 12 = 950400in.; 2ft. 8in. = 32in. 950400 ÷ 32 = 29700 steps, Ans.

8. 2oz. 12dwt. = 52dwt.; 5lb. 2oz. 8dwt. = 1248dwt. ÷ 52 = 24 spoons, Ans.

9. 14ft. 9in. = 177in.; 436 × 1760 = 767360yd. × 3 = 2302080ft. × 12 = 27624960in.; 27624960 ÷ 177 = 156073$\frac{39}{177}$ times, Ans.

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10. $123 \times 78 = 9594$ hills, $\times 4 = 38376$ ears, $\div 8 = 4797$qt. $\div 8 = 599$pk. 5qt. $\div 4 = 149$bu. 3pk. 5qt. Ans.

11. 5yd. 2qr. 3na. $= 91$na.; 182yd. $= 2912$na. $\div 91 = 32$ suits, Ans.

12. 5dwt. 10gr. $= 130$gr.; 3lb. 1oz. 2dwt. 2gr. $= 17810$gr. $\div 130 = 137$ rings, Ans.

13. $18 \div 3 = 6 \times 4 = 24$in.; $56 \times 60 \times 144 = 483840$in. $\div 24 = 20160$ shingles, Ans.

14. $56 \times 25 \times 2 = 2800$ feet, $\times 6 = 16800$ shingles, Ans.

15. 22m. 3fur. 17rd. $= 7177$rd.; 25000m. $= 8000000$rd. $\div 7177 = 1114\frac{8223}{7177}$ days, Ans.

16. 7lb. 10oz. $= 122$oz.; 10cwt. 3qr. 16lb. $= 19520$oz. $\div 122 = 160$ weeks, Ans.

17. 3T. 17cwt. 3qr. 18lb. $= 8726$lb. $\times 7 = 61082$d. $= 254$£. 10s. 2d. Ans.

18. 5cwt. 1qr. 10lb. $= 598$lb. $\times 4\frac{1}{2} = 2691$d. $= 11$£. 4s. 3d. Ans.

19. $63 \times 4 \times 7 \times 9 = \$158.76$ Ans.

20. $54 \times 4 \times 2 \times 15 \times 3 = \$194.40$ Ans.

21. $73 \times 4 \times 8 = 2336$qt. $\times 2 = \$46.72$ Ans.

22. $29 \times 57 = 1653$yd. $\times 15 = \$247.95$ Ans.

23. 6cwt. 2qr. 11lb. + 5cwt. 3qr. 16lb. + 7cwt. 0qr. 7lb. + 3cwt. 1qr. 17lb. $= 22$cwt. 3qr. 23lb. $= 2571$lb. $\times 15 = \$385.65$ Ans.

24. 12cwt. $= 1344$lb.; 3cwt. 2qr. 11lb. + 4cwt. 1qr. 15lb. $= 7$cwt. 3qr. 26lb. $= 894$lb.; $1344 - 894 = 450$lb. $\times 15 = \$67.50$ Ans.

25. 2cwt. 1qr. 7lb. + 3cwt. 2qr. 15lb. + 2cwt. 0qr. 20lb. + 5cwt. 3qr. 17lb. $= 14$cwt. 0qr. 3lb. $= 1571$lb. $\times 37\frac{1}{2} = \$589.12\frac{1}{2}$ Ans.

26. $87 \times 63 = 5481$gal. $\times 33 = \$1808.73$ Ans.

27. 10gal. 1qt. 1pt. 3gi. $= 335$gi.; $63 \times 4 = 252$qt. $\times 2 = 504$pt. $\times 4 = 2016$gi. $- 335$gi. $= 1681$gi. $\times 6 = \$100.86$ Ans.

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28. 100A. 3R. 15p. + 161A. 2R. 28p. + 360A. 3R. 5p. = 623A. 1R. 8p.; 112A. 3R. 30p. + 316A. 1R. 18p. + 168A. 3R. 13p. = 598A. 0R. 21p.; 623A. 1R. 8p.—598A. 0R. 21p. = 25A. 0R. 27p. = 4027p. × 1.35 = $5436.45 Ans.

29. 87gal. 1qt. — 13gal. = 74gal. 1qt. = 2376gi. × .01 = $23.76 Ans.

30. 25cwt. 0qr. 17lb. + 37cwt. 2qr. 17lb. + 18cwt. 3qr. 14lb. + 37cwt. 1qr. 17lb. = 119cwt. 0qr. 9lb. = 13337lb. × .02 = $266.74 Ans.

SECTION XI.

VULGAR FRACTIONS.

CASE VIII.

2. (p. 87.) $\frac{4}{5} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{4}{4800} = \frac{1}{1200}$ Ans.

3. $\frac{3}{5} \times \frac{1}{24} \times \frac{1}{20} \times \frac{1}{12} = \frac{3}{28800} = \frac{1}{9600}$ Ans.

4. $\frac{5}{9} \times \frac{1}{3} \times \frac{1}{8} \times \frac{1}{12} = \frac{5}{2592}$ Ans.

5. $\frac{6}{11} \times \frac{1}{16} \times \frac{1}{28} \times \frac{1}{4} = \frac{6}{19712} = \frac{3}{9856}$ Ans.

6. $\frac{3}{4} \times \frac{1}{28} \times \frac{1}{4} \times \frac{1}{20} = \frac{3}{8960}$ Ans.

7. $\frac{1}{5} \times \frac{1}{2\frac{1}{4}} \times \frac{1}{4} \times \frac{1}{5} = \frac{1}{225}$ Ans.

8. $\frac{4}{7} \times \frac{1}{12} \times \frac{1}{16\frac{1}{4}} \times \frac{1}{40} \times \frac{1}{8} = \frac{4}{43520} = \frac{1}{10880}$ Ans.

9. $\frac{1}{2} \times \frac{1}{3} \times \frac{1}{12} \times \frac{1}{16\frac{1}{2}} \times \frac{1}{40} \times \frac{1}{8} \times \frac{1}{3} = \frac{1}{114048}$ Ans.

10. $\frac{3}{4} \times \frac{1}{144} \times \frac{1}{272\frac{1}{2}} \times \frac{1}{40} \times \frac{1}{4} = \frac{3}{2509056}$ Ans.

11. $\frac{7}{8} \times \frac{1}{4} \times \frac{1}{63} \times \frac{1}{4} = \frac{1}{1152}$ Ans.

12. $\frac{3}{5} \times \frac{1}{2} \times \frac{1}{8} \times \frac{1}{4} = \frac{3}{320}$ Ans.

13. $\frac{1}{8} \times \frac{1}{60} \times \frac{1}{24} \times \frac{1}{365\frac{1}{4}} = \frac{1}{4207680}$ Ans.

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CASE IX.

2. (p. 88.) $\frac{1}{1200} \times \frac{20}{1} \times \frac{12}{1} \times \frac{4}{1} = \frac{960}{1200} = \frac{4}{5}$ Ans.

3. $\frac{1}{960} \times \frac{12}{1} \times \frac{20}{1} \times \frac{24}{1} = \frac{576}{960} = \frac{3}{5}$ Ans.

4. $\frac{5}{2592} \times \frac{12}{1} \times \frac{8}{1} \times \frac{3}{1} = \frac{1440}{2592} = \frac{5}{9}$ Ans.

5. $\frac{3}{9856} \times \frac{4}{1} \times \frac{28}{1} \times \frac{16}{1} = \frac{5376}{9856} = \frac{6}{11}$ Ans.

6. $\frac{3}{8960} \times \frac{20}{1} \times \frac{4}{1} \times \frac{28}{1} = \frac{6720}{8960} = \frac{3}{4}$ Ans.

7. $\frac{1}{225} \times \frac{5}{1} \times \frac{4}{1} \times \frac{21}{1} = \frac{420}{225} = \frac{1}{5}$ Ans.

8. $\frac{1}{110880} \times \frac{8}{1} \times \frac{40}{1} \times \frac{16\frac{1}{2}}{1} \times \frac{12}{1} = \frac{63360}{110880} = \frac{4}{7}$ Ans.

9. $\frac{1}{1140480} \times \frac{3}{1} \times \frac{8}{1} \times \frac{40}{1} \times \frac{16\frac{1}{2}}{1} \times \frac{12}{1} \times \frac{3}{1} = \frac{570240}{1140480} = \frac{1}{2}$ Ans.

10. $\frac{8}{25090560} \times \frac{4}{1} \times \frac{40}{1} \times \frac{272\frac{1}{2}}{1} \times \frac{144}{1} = \frac{1888179220}{25090560} = \frac{3}{4}$ Ans.

11. $\frac{1}{1152} \times \frac{4}{1} \times \frac{63}{1} \times \frac{4}{1} = \frac{1008}{1152} = \frac{7}{8}$ Ans.

12. $\frac{3}{320} \times \frac{4}{1} \times \frac{8}{1} \times \frac{2}{1} = \frac{192}{320} = \frac{3}{5}$ Ans.

13. $\frac{1}{4207680} \times \frac{365\frac{1}{4}}{1} \times \frac{24}{1} \times \frac{60}{1} = \frac{525960}{4207680} = \frac{1}{8}$ Ans.

CASE X.

2.

s.	d.
1	0
	7

24) 7 0

Ans. $3\frac{1}{2}$

3.

s.	d.	qr.
28	0	0
		7

9) 196 0 0

Ans. 21 9 $1\frac{1}{3}$

4.

cwt.	qr.	lb.	oz.	dr.
1	0	0	0	0
				7

11) 7 0 0 0 0

Ans. 2 15 4 $5\frac{9}{11}$

5.

lb.	oz.	dr.
1	0	0
		4

9) 4 0 0

Ans. 7 $1\frac{7}{9}$

6.

lb.	oz.	dwt.	gr.
1	0	0	0
			8

9) 8 0 0 0

Ans. 10 13 8

7.

℔.	ʒ.	ʒ.	℈.	gr.
1	0	0	0	0
				4

13) 4 0 0 0 0

Ans. 3 5 1 $12\frac{4}{13}$

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8.

yd.	qr.	na.	in.
1	0	0	0
			7
13) 7	0	0	0
Ans. 2	0	1	$\frac{5}{13}$

9.

EE.	qr.	na.	in.
1	0	0	0
			5
9) 5	0	0	0
Ans. 2	3	0	$\frac{1}{4}$

10.

m.	fur.	rd.	ft.	in.
1	0	0	0	0
				11
13) 11	0	0	0	0
Ans. 6	30	12	8	$\frac{4}{13}$

11.

fur.	rd.	ft.	in.
1	0	0	0
			8
9) 8	0	0	0
Ans. 35	9	2	

12.

A.	R.	p.	yd.	ft.	in.
1	0	0	0	0	0
					7
13) 7	0	0	0	0	0
Ans. 2	6	4	5	1	$27\frac{5}{13}$

13.

p.	ft.	in.
1	0	0
		9
17) 9	0	0
Ans. 144	19	$\frac{1}{17}$

14.

cord.	ft.	in.
1	0	0
		1
13) 1	0	0
Ans. 9	14	$62\frac{2}{13}$

15.

hhd.	gal.	qt.	pt.	gl.
1	0	0	0	0
				2
19) 2	0	0	0	0
Ans. 6	2	1	0	$\frac{4}{19}$

16.

hhd.	gal.
1	0
	7
9) 7	0
Ans. 42	

17.

year.	da.	h.	m.	sec.
1	0	0	0	0
				11
23) 11	0	0	0	0
Ans. 174	16	26	5	$\frac{5}{23}$

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18.

$$7\frac{3\frac{3}{11}}{4\frac{2}{5}} = 7\frac{90}{121} = \$7.74\frac{46}{121} \text{ Ans.}$$

NOTE.—We multiply each of the fractions, $\frac{3}{11}$ and $\frac{2}{5}$, by 55, because it is the multiple of 11 and 5, the denominators.

CASE XI.

7. (p. 90.) 1s. = 48qr.; $3\frac{1}{2}$d. = 14qr.; $\frac{14}{48} = \frac{7}{24}$ Ans.

8. $21\times12+9=261\times4+1=1045\times3+1=3136$
$28\times12\times4\times3=4032 = \frac{7}{9}$ Ans.

9. $2\times28+15=71\times16+4=1140\times16+5=18245\times11+9=200704$
$4\times28\times16\times16\times11=315392$
$= \frac{7}{11}$ Ans.

10. $7\times16+1=113\times9+7=1024$
$16\times16\times9=2304 = \frac{4}{9}$ Ans.

11. $10\times20+13=213\times24+8=5120$
$12\times20\times24=5760 = \frac{8}{9}$ Ans.

12. $3\times8+5=29\times3+1=88\times20+12=1772\times13+4=23040$
$12\times8\times3\times20\times13=74880 = \frac{4}{13}$ Ans.

13. $2\times4=8\times2\frac{1}{4}+1=19\times13+5=252$
$4\times4\times2\frac{1}{4}\times13=468 = \frac{7}{13}$ Ans.

14. $2\times4+3=11\times2\frac{1}{4}=24\frac{3}{4}\times4+1=100$
$5\times4\times2\frac{1}{4}\times4=180 = \frac{5}{9}$ Ans.

15. $6\times40+30=270\times16\frac{1}{2}+12=4467\times12+8$
$=53612\times3=160836\times13+12$
$8\times40\times16\frac{1}{2}\times12\times3\times13=2471040 = \frac{2090880}{2471040} = \frac{11}{13}$ Ans.

16. $35\times16\frac{1}{2}+9=586\frac{1}{2}\times12+2=7040$
$40\times16\frac{1}{2}\times12=7920 = \frac{8}{9}$ Ans.

17. $2\times40+6=86\times30\frac{1}{4}+4=2605\frac{1}{2}\times9+5=$
$23454\frac{1}{2}\times144+127=3377575\times13+5$
$4\times40\times30\frac{1}{4}\times9\times144\times13=81544320 = \frac{43908480}{81544320} = \frac{7}{13}$ Ans.

18. $144\times144+19=20755\times17+1=352836$
$272\frac{1}{4}\times144\times17=666468 = \frac{9}{17}$ Ans.

19. $9\times1728+1462=17014\times13+2=221184$
$128\times1728\times13=2875392 = \frac{1}{13}$ Ans.

20. $6\times4+2=26\times2+1=53\times4=212\times19+4=4032$
$63\times4\times2\times4\times19=38304 = \frac{2}{19}$ Ans.

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21. $\frac{4}{63}\frac{2}{3} = \frac{7}{9}$ Ans.

22. $174 \times 24 + 16 = 4192 \times 60 + 26 = 251546 \times 60 + 5 = 15092765 \times 23 + 5 = 347133600$

$365\frac{1}{4} \times 24 \times 60 \times 60 \times 23 = 725824800$

$= \frac{11}{23}$ Ans.

SECTION XII.

ADDITION OF VULGAR FRACTIONS.

CASE IV.

(p. 95.)

2.

	£.	s.	d.
$\frac{4}{5}$ of a £. =	0	8	$10\frac{2}{5}$
$\frac{3}{7}$ of a £. =	0	8	$6\frac{6}{7}$
$\frac{3}{5}$ of a s. =	0	0	$4\frac{4}{5}$
Ans.	0	17	$10\frac{34}{105}$

3.

	cwt.	qr.	lb.
$\frac{7}{11}$ of a ton =	12	2	$25\frac{5}{11}$
$\frac{17}{22}$ of a cwt. =		3	$2\frac{6}{11}$
Ans.	13	2	0

4.

	qr.	na.	in.
$\frac{3}{5}$ of yd. =	2	1	$1\frac{7}{20}$
$\frac{1}{7}$ of an EE. =		2	$1\frac{13}{14}$
$\frac{6}{7}$ of a qr. =		3	$0\frac{27}{28}$
Ans.	3	3	$1\frac{139}{140}$

5.

	fur.	rd.	ft.	in.	br.
$\frac{7}{11}$ of a mile =	5	3	10	6	0
$\frac{4}{13}$ of a furlong =		12	5	0	$2\frac{10}{13}$
$\frac{8}{22}$ of a yard =			1	2	$2\frac{2}{11}$
	5	15	16	9	$1\frac{136}{143} =$
Ans.	5	16	0	3	$1\frac{136}{143}$

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6.

	A.	R.	p.	ft.	in.
$\frac{5}{7}$ of an A. =	0	2	34	77	$113\frac{1}{7}$
$\frac{2}{3}$ of an A. =	0	2	26	181	72
$\frac{13}{14}$ of an A. =	0	3	28	155	$82\frac{2}{7}$
	2	1	9	$141\frac{3}{4}$	$123\frac{3}{7}$ =
Ans.	2	1	9	142	$87\frac{3}{7}$

7.

	m.	fur.	rd.	ft.	in.
$18\frac{3}{7}$ miles =	18	3	17	2	$4\frac{2}{7}$
$23\frac{11}{14}$ miles =	23	6	11	7	$0\frac{6}{7}$
$19\frac{1}{21}$ miles =	19	0	15	3	$11\frac{1}{7}$
Ans.	61	2	3	13	$4\frac{2}{7}$

8.

	gal.	qt.	pt.	gi.
$\frac{11}{12}$ of a gal. =	0	3	1	$1\frac{1}{3}$
$\frac{1}{12}$ of a hhd. =	5	1	0	0
Ans.	6	0	1	$1\frac{1}{3}$

9.

	d.	h.	m.
$\frac{5}{16}$ of a week =	2	4	30
$\frac{1}{5}$ of a day =		4	48
Ans.	2	9	18

10.

	ft.	in.
$\frac{3}{4}$ of a square ft. =	0	108
$\frac{1}{2}$ a foot square =		36
Ans.	1	0

11.

	rd.	ft.	in.
	11	16	5
			6
	11	16	11 =
Ans.	12	0	5

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SECTION XIII.

SUBTRACTION OF VULGAR FRACTIONS.

CASE V.

(p. 100.)

2.

	cwt.	qr.	lb.	oz.	dr.
$\frac{2}{31}$ of a ton =	1	1	4	8	$4\frac{4}{31}$
$\frac{4}{5}$ of a cwt. =		3	5	9	$9\frac{3}{5}$
Ans.	0	1	26	14	$10\frac{82}{155}$

3.

	qr.	na.	in.
$\frac{7}{8}$EE. =	4	1	$1\frac{1}{8}$
$\frac{3}{7}$ of a yd. =	1	0	$1\frac{3}{7}$
Ans.	3	0	$2\frac{5}{56}$

4.

	fur.	rd.	ft.	in.
$\frac{3}{8}$ of a mile =	1	31	1	10
$\frac{7}{11}$ of a fur. =		25	7	6
	1	5	$10\frac{1}{2}$	4 =
Ans.	1	5	10	10

5.

	m.	fur.	rd.	ft.	in.	br.
$\frac{5}{7}$ deg. =	49	5	5	11	9	$1\frac{3}{7}$
$\frac{3}{5}$ mile =		4	32	0	0	0
Ans.	49	0	13	11	9	$1\frac{3}{7}$

6.

	R.	p.	yd.	ft.	in.
$\frac{4}{11}$A. =	1	18	5	4	72
$\frac{1}{8}$ rod =	0	0	13	4	0
	1	17	$22\frac{1}{4}$	0	72
			$\frac{1}{4}$ =	2	36
Ans.	1	17	22	2	108

7.

	ft.	in.
$\frac{9}{10}$ cord =	115	$345\frac{3}{5}$
$\frac{2}{11}$ cord =	23	$471\frac{3}{11}$
Ans.	91	$1602\frac{18}{55}$

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8.

	gal.	qt.	pt.	gl.
$\frac{7}{13}$hhd. =	33	3	1	$1\frac{7}{13}$
$\frac{4}{5}$ of $\frac{7}{13}$hhd. = $\frac{28}{65}$ =	27	0	1	$0\frac{28}{65}$
Ans.	6	3	0	$1\frac{7}{65}$

9.

	m.	fur.	rd.	ft.	in.	br.
72m. =	72	0	0	0	0	0
$\frac{4}{7}$ of 72m. =	41	1	5	11	9	$1\frac{3}{7}$
	30	6	34	$4\frac{1}{2}$	2	$1\frac{4}{7}$
				$\frac{1}{2}$ =	6	0
Ans.	30	6	34	4	8	$1\frac{4}{7}$

10.

	day.	h.	m.	sec.
$\frac{2}{7}$ year =	104	8	34	$17\frac{1}{7}$
$\frac{4}{5}$ week =	3	2	40	0
Ans.	101	5	54	$17\frac{1}{7}$

11.

	R.	p.	yd.	ft.	in.
$\frac{4}{11}$A. =	1	18	5	4	72
$\frac{1}{2}$ft. =					72
Ans.	1	18	5	4	0

SECTION XVII.

ADDITION OF DECIMALS.

(p. 111.)

6.

73.29
87.047
3005.0106
28.03
29000.005
Ans. 32193.3826

7.

209000.000046
98207.0015
15.08
.0049
Ans. 307222.086446

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8.

23000010.
1000.00005
27.000019
7.5

Ans. 23001044.500069

9.

59.059
25000.0025
5.000005
205.05

Ans. 25269.111505

10.

25.000007
145.643
175.89
17.00348

Ans. 363.536487

SECTION XVIII.

SUBTRACTION OF DECIMALS.

(p. 112.)

9.

97.7
27.028

Ans. 70.672

10.

315.0027
115.07

Ans. 199.9327

11.

29004005.
29000.
349200.00024
378200.00024

Ans. 28625804.99976

12.

1000000.
.000001

Ans. 999999.999999

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SECTION XXIV.

CIRCULATING DECIMALS.

CASE I.

2. (p. 124.) $.\dot{3} = \frac{3}{9} = \frac{1}{3}$ Ans.

3. $1.6\dot{2} = 1.\dot{6}2\dot{1} = 1\frac{621}{999} = 1\frac{23}{37}$ Ans.

4. $.769230\dot{} = \frac{769230}{999999} = \frac{10}{13}$ Ans.

CASE II.

2. $.5\dot{3} = \frac{5}{10} + \frac{3}{90} = \frac{8}{15}$ Ans.

3. $.5\dot{9}2\dot{5} = \frac{5}{10} + \frac{925}{9990} = \frac{5920}{9990} = \frac{16}{27}$ Ans.

4. $.008\dot{4}97133\dot{} = \frac{8}{1000} + \frac{497133}{999999000} = \frac{83}{9768}$ Ans.

5. $3\dot{1}.6\dot{2} = 31.621 = 31\frac{621}{999} = 31\frac{23}{37}$ Ans.

CASE III.

2. $3.\dot{6}7\dot{1} = 3.\dot{6}71671671\dot{6}7\dot{1}$; $1.\dot{0}07\dot{1} = 1.\dot{0}07100710071\dot{0}0\dot{7}\dot{1}$; $8.5\ddot{2} = 8.525252525\dot{2}$; $7.\dot{6}1632\dot{5} = 7.\dot{6}16325616325$ Ans.

3. $1.5\ddot{2} = 1.52\dot{5}2\dot{5}2$; $8.\dot{7}15\dot{6} = 8.71\dot{5}67\dot{1}$; $3.56\dot{7} = 3.567777$; $1.3\dot{7}\dot{8} = 1.378787$ Ans.

4. $.00\ddot{7} = .000\dot{7}0707\dot{0}$; $.14\dot{1}4\dot{1}\dot{4} = .1414144\dot{1}\dot{4}$; $887.\dot{1} = 887.111\dot{1}11111\dot{1}$ Ans.

CASE IV.

3. As the denominator 11 cannot be divided by 2, 5, or 10, the decimal is infinite. Then, $11)\frac{9}{9}$. As two 9's are used, the circulate will consist of two places; thus, $\begin{array}{r} 11)1.00 \\ \hline .0\dot{9} \end{array}$ Ans.

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4. $253)\underline{9999999999999999999999}$ $3952569169960474308 3$. As twenty-two 9's are necessary to complete the division without a remainder, so we infer that the repetend will consist of twenty-two places; thus, $\frac{107}{253} = .\dot{4}2292490118577075098 8\dot{1}$ Ans.

SECTION XXV.

ADDITION OF CIRCULATING DECIMALS

(p. 127.)

2.

$$\begin{array}{rcl} 2\dot{7}.5\dot{6} & = & 27.5\dot{6}75675675675\dot{6} \\ 5.\dot{6}3\dot{2} & = & 5.6\dot{3}26326326326\dot{6} \\ 6.\dot{7} & = & 6.7\dot{7}7777777777\dot{7} \\ 16.3\dot{5}\dot{6} & = & 16.3\dot{5}65656565656\dot{6} \\ .7\dot{1} & = & .7\dot{1}1111111111\dot{1} \\ 6.\dot{1}23\dot{4} & = & 6.1\dot{2}3412341234\dot{1} \\ \hline \text{Ans.} & & 63.1\dot{6}90670868888\dot{8} \end{array}$$

3.

$$\begin{array}{rcl} 2.7\dot{6}\dot{5} & = & 2.7\dot{6}56\dot{5} \\ 7.1\dot{6}67\dot{4} & = & 7.1\dot{6}67\dot{4} \\ \dot{3}.67\dot{1} & = & 3.6\dot{7}13\dot{6} \\ .\dot{7} & = & .7\dot{7}77\dot{7} \\ .\dot{1}72\dot{8} & = & .1\dot{7}28\dot{1} \\ \hline \text{Ans.} & & 14.5\dot{5}43\dot{6} \end{array}$$

4.

$$\begin{array}{rcl} 5.\dot{1}634\dot{5} & = & 5.\dot{1}63451634516345163\dot{4}\dot{5} \\ 8.\dot{6}38\dot{1} & = & 8.\dot{6}38163816381638163\dot{8}\dot{1} \\ 3.\dot{7}\dot{5} & = & 3.\dot{7}57575757575757575\dot{7}\dot{5} \\ \hline \text{Ans.} & & 17.\dot{5}5919120847374090302\dot{2} \end{array}$$

5.

$$\begin{array}{rcl} \frac{1}{3} = .\dot{3} & = & .\dot{3}3333\dot{3} \\ \frac{1}{7} = .\dot{1}4285\dot{7} & = & .\dot{1}4285\dot{7} \\ \frac{1}{9} = .\dot{1} & = & .\dot{1}1111\dot{1} \\ \hline \text{Ans.} & & .\dot{5}8730\dot{1} \end{array}$$

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SECTION XXVI.

SUBTRACTION OF CIRCULATING DECIMALS.

(p. 128.)

2.

$7.\dot{1} = 7.1\dot{1}$
$5.0\dot{2} = 5.0\dot{2}$

Ans. $2.0\dot{8}$

3.

$315.\dot{8}\dot{7} = 315.\dot{8}75875875\dot{8}75$
$78.0\dot{3}7\dot{8} = 78.\dot{0}37803780\dot{3}78$

Ans. $237.\dot{8}38072095\dot{4}9\dot{7}$

4.

$\frac{2}{9} = .\dot{2} = .\dot{2}22222\dot{2}$
$\frac{1}{7} = .\dot{1}42857 = .\dot{1}42857\dot{1}$

Ans. $.\dot{0}79365\dot{5}$

5.

$16.134\dot{7} = 16.134\dot{7}$
$11.08\dot{8}4 = 11.08\dot{8}4$

Ans. $5.046\dot{2}$

6.

$18.167\dot{8} = 18.167\dot{8}$
$3.\dot{2}7 = 3.27\dot{2}7$

Ans. $14.895\dot{1}$

7.

$3.\dot{1}2\dot{3} = 3.\dot{1}23123\dot{3}$
$.7\dot{1} = .717171\dot{1}$

Ans. $2.\dot{4}05951\dot{1}$

8.

$\frac{3}{7} = .\dot{4}2857\dot{1} = .\dot{4}2857\dot{1}$
$\frac{2}{11} = .\dot{1}\dot{8} = .\dot{1}81818$

Ans. $.\dot{2}46753$

9.

$\frac{4}{9} = .\dot{4} = .\dot{4}44444$
$\frac{2}{7} = .\dot{2}85714 = .\dot{2}85714$

Ans. $.\dot{1}58730$

10.

$\frac{8}{17} = .\dot{5}2941176470588\dot{2}3$
$\frac{6}{17} = .\dot{3}5294117647058\dot{8}2$

Ans. $.\dot{1}76470588235294\dot{1}$

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11.

$5.\dot{1}2345 = 5.1\dot{2}345123451234512345123451234\dot{5}\dot{1}$

$2.35\dot{2}3456 = 2.35\dot{2}3456523456523456523456523456\dot{5}$

Ans. $2.771105582166692777798888859999\dot{4}$

SECTION XXVII.

MULTIPLICATION OF CIRCULATING DECIMALS.

(p. 129.)

3.

$87.32\dot{5}8\dot{6}$

437

61128106

26197759_7

34930346_{34}

Ans. $381.6140\dot{3}3\dot{8}$

4. $3.1\dot{4}\dot{5} = 3.1\frac{45}{99} = 3.1\frac{5}{11} = \frac{348}{110}$; $4.\dot{2}9\dot{7} = 4\frac{297}{999} = 4\frac{11}{37} = \frac{159}{37}$; $\frac{348}{110} \times \frac{159}{37} = \frac{55014}{4070} = 13.5\dot{1}69533$ Ans.

5.

$.\dot{2}85714\dot{2}$

28

2285714

5714285

Ans. $8.\dot{0}00000\dot{0}$

6.

$.461607\dot{1}42857\dot{2}$

20

$9)232142857142$

4

$0)928571428571$

28

7428571428571

1857142857142_8

Ans. $26.000000\dot{0}00000\dot{0}$

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7.

$$
\begin{array}{r}
.2\dot{8}4931506\dot{6} \\
365 \\
\hline
1424657534 \\
1709589041_{0} \\
854794520_{54} \\
\hline
\text{Ans. } 104.0\dot{0}0000000\dot{0}
\end{array}
$$

SECTION XXVIII.

DIVISION OF CIRCULATING DECIMALS.

2. (p. 130.) $345.\dot{8} = 345.\frac{8}{9}$; $\dot{6} = \frac{6}{9} = \frac{2}{3}$; $345\frac{8}{9} \div \frac{2}{3} = 518\frac{5}{6} = 518.8\dot{3}$ Ans.

3. $234.\dot{6} = 234\frac{2}{3}$; $\dot{7} = \frac{7}{9}$; $234\frac{2}{3} \div \frac{7}{9} = 301\frac{5}{7} = 301.\dot{7}1428\dot{5}$ Ans.

4. $.\dot{3}\dot{6} = \frac{36}{99} = \frac{12}{33}$; $.2\dot{5} = \frac{2}{10} + \frac{5}{90} = \frac{23}{90}$; $\frac{12}{33} \div \frac{23}{90} = \frac{12}{33} \times \frac{90}{23} = \frac{1080}{759} = 1.\dot{4}2292490118577075098\dot{8}1$ Ans.

SECTION XXXI.

PARTIAL PAYMENTS.

(p. 140.)

2.

Principal, ...	$700.00.0
Interest from Feb. 4 to Nov. 28, 9mo. 24da. .	34.30.0
Amount carried forward, ...	$734.30.0

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Amount brought forward, ...		$734.30.0
First payment, ...	160.00.0	
Interest from March 18 to Nov. 28, 8mo. 10da.	6.66.6	
Second payment, ...	200.00.0	
Interest from June 24 to Nov. 28, 5mo. 4da.	5.13.3	
Third payment, ...	120.00.0	
Interest from Sept. 11 to Nov. 28, 2mo. 17da.	1.54.0	
Fourth payment, ...	60.00.0	
Interest from Oct. 5 to Nov. 28, 1mo. 23da.	.53.0	
		553.86.9
Balance remaining due Nov. 28, 1834, . . .		$180.43.1

3.

Principal, bearing interest from Aug. 16, 1834,		$600.00.0
Interest from Aug. 16, 1834, to Aug. 1, 1835, 11mo. 15da.		34.50.0
Amount, ...		634.50.0
First payment, Sept. 18, 1834, . . .	136.00.0	
Interest from Sept. 18, 1834, to Aug. 1, 1835, 10mo. 13da.	7.09.4	
Second payment, Dec. 5, 1834, . . .	197.00.0	
Interest from Dec. 5, 1834, to Aug. 1, 1835, 7mo. 26da.	7.74.8	
Amounts carried forward,	$347.84.2	$634.50.0

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Amounts brought forward,	$347.84.2	$634.50.0
Third payment, Feb. 11, 1835, . . .	200.00.0	
Interest from Feb. 11, 1835, to Aug. 1, 1835, 5mo. 20da.	5.66.6	
Fourth payment, April 19, 1835, . .	40.00.0	
Interest from April 19, 1835, to Aug. 1, 1835, 3mo. 12da.	.68.0	
		594.18.8
Balance remaining due Aug. 1, 1835, ...		$40.31.2

5.

Principal, on interest from June 17, 1829, . .	$769.87.0
Interest from June 17, 1829, to March 1, 1830, 8mo. 14da.	32.59.1
Amount, ...	802.46.1
First payment, March 1, 1830, ...	75.50.0
New principal, bearing interest from Mar. 1, 1830,	726.96.1
Interest from March 1, 1830, to June 11, 1831, 15mo. 10d.	55.73.3
Amount, ...	782.69.4
Second payment, June 11, 1831, ...	165.00.0
New principal, bearing interest from June 11, 1831,	617.69.4
Interest from June 11, 1831, to Sept. 15, 1831, 3mo. 4da.	9.67.7
Amount, ...	627.37.1
Third payment, Sept. 15, 1831, ...	161.00.0
New principal, bearing interest from Sept. 15, 1831, carried forward, ...	$466.37.1

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Amount brought forward, . . .		$466.37.1
Interest from Sept. 15, 1831, to Jan. 21, 1832, 4mo. 6da.		9.79.3
Amount, ...		476.16.4
Fourth payment, January 21, 1832, ...		47.25.0
New principal, bearing interest from Jan. 21, 1832,		428.91.4
Interest from Jan. 21, 1832, to Dec. 6, 1833, 22mo. 15da.		48.25.2
Amount, ...		477.16.6
Fifth payment, less than interest, March 5, 1833, ...	12.17	
Sixth payment, more than interest, Dec. 6, 1833, ...	98.00	
		110.17.0
New principal, bearing interest from Dec. 6, 1833,		366.99.6
Interest from Dec. 6, 1833, to July 7, 1834, 7mo. 1d.		12.90.6
Amount, ...		379.90.2
Seventh payment, July 7, 1834, ...		169.00.0
New principal, bearing interest from July 7, 1834,		210.90.2
Interest from July 7, 1834, to Sept. 25, 1835, 14mo. 18da.		15.39.5
Balance due Sept. 25, 1835, ...		$226.29.7

6.

Principal, on interest from April 30, 1831, . .	$300.00.0
Interest from April 30, 1831, to June 27, 1832, 13mo. 27da.	20.85.0
Amount carried forward, . . .	$320.85.0

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Amount brought forward, . . .		$320.85.0
First payment, June 27, 1832, ...		150.00.0
New principal, bearing interest from June 27, 1832,		170.85.0
Interest from June 27, 1832, to Dec. 9, 1832, 5mo. 12da.		4.61.2
Amount, ...		175.46.2
Second payment, Dec. 9, 1832, ...		150.00.0
New principal, bearing interest from Dec. 9, 1832,		25.46.2
Interest from Dec. 9, 1832, to Oct. 9, 1833, 10mo.		1.27.3
Balance due Oct. 9, 1833, ...		$26.73.5

7.

Principal, on interest from Feb. 11, 1832, . . .		$54.18.0
Interest from Feb. 11, 1832, to July 11, 1833, 17mo.		4.60.5
Amount, ...		58.78.5
First payment, July 11, 1833, ...		12.25.0
Principal, bearing interest from July 11, 1833, .		46.53.5
Interest from July 11, 1833, to Aug. 21, 1835, 25mo. 10da.		5.89.4
Amount, ...		52.42.9
Second payment, less than interest, Aug. 15, 1834, ...	2.10.0	
Third payment, less than interest, July 9, 1835, ...	3.12.0	
Amounts carried forward, .	$5.22.0	$52.42.9

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Amounts brought forward, .	$5.22.0	$52.42.9
Fourth payment, more than interest, Aug. 21, 1835, ...	37.18.0	
		42.40.0
Principal, bearing interest from Aug. 21, 1835,		10.02.9
Interest from Aug. 21, 1835, to Dec. 17, 1835, 3mo. 26da.		.19.3
Balance due, Dec. 17, 1835, ...		$10.22.2

8.

Principal, on interest from Jan. 7, 1831, . .		$1728.00.0
Interest from Jan. 7, 1831, to Feb. 9, 1832, 13mo. 2da.		112.89.6
Amount, ...		1840.89.6
First payment, Feb. 9, 1832, ...		760.28.5
Principal, bearing interest from Feb. 9, 1832, .		1080.61.1
Interest from Feb. 9, 1832, to Dec. 28, 1833, 22mo. 19da.		122.28.9
Amount, ...		1202.90.0
Second payment, less than interest, Mar. 5, 1833, ...	68.50	
Third payment, more than interest, Dec. 28, 1833, ...	876.28	
		944.78.0
Principal, bearing interest from Dec. 28, 1833, .		258.12.0
Interest from Dec. 28, 1833, to July 17, 1834, 6mo. 19da.		8.56.0
Amount carried forward, ...		$266.68.0

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Amount brought forward, . . .	$266.68.0
Fourth payment, July 17, 1834, ...	60.00.0
Principal, bearing interest from July 17, 1834, .	206.68.0
Interest from July 17, 1834, to Oct. 1, 1834, 2mo. 14da.	2.54.9
Balance due Oct. 1, 1834, ...	$209.22.9

9.

Principal, on interest from May 7, 1829, . .	$500.00.0
Interest from May 7, 1829, to June 29, 1830, 13mo. 22da.	34.33.3
Amount, ...	534.33.3
First payment, June 29, 1830, ...	100.00.0
New principal, carrying interest from June 29, 1830, ...	434.33.3
Interest from June 29, 1830, to Dec. 5, 1831, 17mo. 6da.	37.35.2
Amount, ...	471.68.5
Second payment, Dec. 5, 1831, ...	100.00.0
New principal carrying interest from Dec. 5, 1831,	371.68.5
Interest from Dec. 5, 1831, to July 4, 1833, 18mo. 29da.	35.24.8
Amount, ...	406.93.3
Third payment, March 12, 1832, less than interest, ... 5.00	
Fourth payment, July 4, 1833, more than interest, ... 95.00	
	100.00.0
New principal, carrying interest from July 4, 1833, *carried* forward, ...	$306.93.3

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Amount brought forward, . . .	$306.93.3
Interest from July 4, 1833, to Dec. 1, 1834, 16mo. 27da.	25.93.6
Amount, ...	332.86.9
Fifth payment, Dec. 1, 1834, ...	200.00.0
New principal, carrying interest from Dec. 1, 1834,	132.86.9
Interest from Dec. 1, 1834, to Jan. 1, 1836, 13mo.	8.63.6
Balance due Jan. 1, 1836, ...	$141.50.5

10.

Principal, on interest from March 19, 1831, . .	$89.75.0
Interest from March 19, 1831, to Dec. 6, 1831, 8mo. 17da.	3.84.4
Amount, ...	93.59.4
First payment, Dec. 6, 1831, ...	12.12.0
New principal, bearing interest from Dec. 6, 1831,	81.47.4
Interest from Dec. 6, 1831, to Feb. 17, 1832, 2mo. 11da.	.96.4
Amount, ...	82.43.8
Second payment, Feb. 17, 1832, ...	12.12.0
New principal, bearing interest from Feb. 17, 1832, ...	70.31.8
Interest from Feb. 17, 1832, to Jan. 1, 1835, 34mo. 14da.	12.11.8
Amount carried forward, ...	$82.43.6

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Amount brought forward, ...		$82.43.6
Third payment, March 19, 1833, less than interest, ...	3.16	
Fourth payment, Dec. 28, 1834, less than interest, ...	2.18	
Fifth payment, Jan. 1, 1835, more than interest, ...	25.25	
		30.59.0
New principal, bearing interest from Jan. 1, 1835,		51.84.6
Interest from Jan. 1, 1835, to March 11, 1835, 2mo. 10da.		.60.4
Amount, ...		52.45.0
Sixth payment, March 11, 1835, ...		31.18.0
New principal, bearing interest from Mar. 11, 1835,		21.27.0
Interest from March 11, 1835, to July 17, 1835, 4mo. 6da.		.44.6
Amount, ...		21.71.6
Seventh payment, July 17, 1835, ...		5.18.0
New principal, bearing interest from July 17, 1835,		16.53.6
Interest from July 17, 1835, to Sept. 1, 1835, 1mo. 14da.		.12.1
Amount, ...		16.65.7
Eighth payment, Sept. 1, 1835, ...		6.29.0
New principal, bearing interest from Sept. 1, 1835,		10.36.7
Interest from Sept. 1, 1835, to Dec. 29, 1835, 3mo. 28da.		.20.3
Balance due Dec. 29, 1835, ...		$10.57.0

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SECTION XXXII.

MISCELLANEOUS PROBLEMS.

2. (p. 146.) $120 × .01 = 1.20 × 1⅓ = 1.60; 133.20 — 120 = 13.20 ÷ 1.60 = 8¼ per cent. Ans.

3. $280 × .01 = 2.80 × 6½ = 18.20; 411.95 — 280 = 131.95 ÷ 18.20 = 7¼ per cent. Ans.

5. $120 × .08¼ = 9.90; 133.20 — 120 = 13.20 ÷ 9.90 = 1⅓ y. = 16 months, Ans.

6. $280 × .07¼ = 20.30; 411.95 — 280 = 131.95 ÷ 20.30 = 6½ years, Ans.

8. $1.00 × .08¼ = .0825 × 1⅓ = .11; 13.20 ÷ .11 = $120.00 Ans.

9. .07¼ = .0725 × 6½ = .47125 + 1 = 1.47125; 411.95 ÷ 1.47125 = $280.00.

MISCELLANEOUS QUESTIONS.

1. (p. 148.) $1728 × .15 = 259.20; 1728 — 260.20 = $1468.80 Ans.

2. $15000 × .12½ = 1875; 15000 — 1875 = $13125 × .25 = 3281.25; 13125 — 3281.25 = $9843.75 Ans.

3. $560 × .12½ = $70.00; $400 × .18 = $72.00 — 70.00 = $2.00 Ans.

4. .12 + .20 + .40 = .72; $1890 × .72 = $1360.80; 1890 — 1360.80 = 529.20 ÷ 2646 = .20 Ans.

SECTION XXXIII.

DISCOUNT.

2. (p. 148.) $1.12 amount of $1, for the given time; $117.60 ÷ 1.12 = $105.00 Ans.

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3. $1.07 amount of $1, for the given time; $802.50 ÷ 1.07 = $750; $802.50 — 750 = $52.50 Ans.

4. $1.205 amount of $1, for 3y. 5mo.; $769.60 ÷ 1.205 = $638.67.$2\frac{48}{241}$ Ans.

5. $1.46.8$\frac{1}{3}$ amount of $1, for 7y. 9mo. 20da.; $986.40 ÷ 1.46.8$\frac{1}{3}$ = $671.78.$2\frac{588}{881}$ Ans.

6. $\frac{16}{16}$ = amount, $\frac{15}{16}$ = principal, $\frac{1}{16}$ = discount. Therefore, 32 × 16 = 512 ÷ 15 = $34\frac{2}{15}$qts. Ans.

7. $1.26875 amount of $1, for 3y. 7mo.; $678.75 ÷ 1.26875 = $534.97.$5\frac{75}{203}$ Ans.

8. 1.091\frac{5}{6}$ amount of $1, for 18mo. 11da.; $1000 ÷ 1.091$\frac{5}{6}$ = 915.89\frac{461}{6551}$ Ans.

9. 1.017\frac{2}{3}$ amount of $1, for 3mo. 16da.; $715.50 ÷ 1.017$\frac{2}{3}$ = $703.07.$8\frac{2866}{30053}$ Ans.

10. $1.054 amount of $1, for 10mo. 24da.; $914.75 ÷ 1.054 = $867.88.$4\frac{133}{527}$ Ans.

11. 1.056\frac{5}{6}$ amount of $1, for 11mo. 11da.; $79.87 ÷ 1.056$\frac{5}{6}$ = $75.57.4 +.

1.111\frac{1}{6}$ amount of $1, for 22mo. 7da.; $87.75 ÷ 1.111$\frac{1}{6}$ = $78.97.1 + $75.57.4 = $154.54.5 + Ans.

12. 1.250\frac{1}{2}$ amount of $1, for 50mo. 3da.; $1728 ÷ 1.250$\frac{1}{2}$ = $1381.84.$7\frac{653}{2501}$ Ans.

13. $5.00 × 1.10 = $5.50; $1.00 — .10 = .90; 5.50 ÷ .90 = 6.11\frac{1}{3}$ Ans.

14. $1.118 amount of $1, for 23mo. 18da.; $365.87 ÷ 1.118 = $327.25.4 +.

$1.1525 amount of $1, for 30mo. 15da.; $161.15 ÷ 1.1525 = $139.82.6 +.

1.028\frac{2}{3}$ amount of $1, for 5mo. 22da.; $112.50 ÷ 1.028$\frac{2}{3}$ = $109.36.4 +.

$1.258 amount of $1, for 51mo. 18da.; $96.81 ÷ 1.258 = $76.95.5 +.

$327.25.4 + $139.82.6 + $109.36.4 + $76.95.5 + = $653.40 + Ans.

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15. First find the interest on the shoes from the time they become due until the time of settlement; add this interest to the value of the shoes.

$\$865 \times 1.068\frac{5}{6} = \$924.54$; $\$386.27 \times 1.063\frac{2}{3} = \$410.86$.

$\$769.25 \times 1.056\frac{2}{3} = \$812.84$; $\$183.75 \times 1.047\frac{1}{3} = \$192.44$.

$\$396.81 \times 1.043\frac{1}{3} = 414.00$.

$\$924.54 + \$410.86 + \$812.84 + \$192.44 + \$414.00 = \$2754.68$ amount of the shoes.

Then find the amount of the sums A B has received, from the time when received to the time of settlement.

$\$1000 \times 1.061\frac{1}{3} = 1061.33$; $\$375.25 \times 1.053\frac{1}{3} = \$395.26$.

$\$681.29 \times 1.049 = \$714.67$; $\$100 \times 1.045\frac{1}{3} = \$104.51$.

$\$275.28 \times 1.029\frac{1}{2} = \$283.40$.

$\$1061.33 + \$395.26 + \$714.67 + \$104.51 + \$283.40 = \$2559.17$ amount of the sums received; $\$2754.68 - \$2559.17 = \$195.51$ Ans.

SECTION XXXIV.

COMMISSION AND BROKERAGE.

1. (p. 150.) $\$18768 \times .01\frac{3}{4} = \$328.44$ Ans.

2. $\$896 \times .02 = \$17.92$ Ans.

3. $395£.\ 15s.\ 5d. \times .02\frac{1}{4} = 8£.\ 18s.\ 1\frac{8}{100}d.$ Ans.

4. $\$1976 \times \frac{100}{104} = \$1900$ Ans.

5. $\$102.50 \times 90 = \$9225 \div 2\frac{1}{2} = \$3690$ the sum remitted; $\$3690 - \$90 = \$3600 \div 95 = 37T.\ 17cwt.\ 3qr.\ 16\frac{4}{19}lb.$ Ans.

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SECTION XXXV.

STOCKS.

2. (p. 151.) $\$100 \times 15 = \$1500 \times 1.13 = \$1695$ Ans.
3. $\$100 \times 12 = \$1200 \times 1.15 = \$1380.00$ Ans.
4. $1058£.\ 12s. \times 1.15\frac{3}{4} = 1225£.\ 6s.\ 7\frac{2}{5}d.$ Ans.
5. $\$100 \times 30 = \$3000 \times 1.08\frac{3}{4} = \$3262.50$ Ans.
6. $\$100 \times 10 = \$1000 \times .85 = \$850$ Ans.
7. $\$100 \times 5 = \$500 \times 1.07 = \$535$ Ans.

SECTION XXXVI.

INSURANCE AND POLICIES.

1. (p. 152.) $\$896 \times .12 = \$107.52$ Ans.
2. $\$850 \times .18\frac{1}{2} = \$157.25$ Ans.
3. $\$9870 \times .07 = \$690.90$ Ans.
4. $\$1.00 - .15 = .85$; $\$1728 \times .85 = \$1468.80$ Ans.
5. $\$1.00 - .10 = .90$; $\$2475 \div .90 = \$2750$ Ans.
6. $\$1.00 - .12\frac{1}{2} = .87\frac{1}{2}$; $\$26250 \div .87\frac{1}{2} = \$30.000$ Ans.
7. $\$3600 \times .60 = \$2160$ Ans.
8. $\$1.00 - .10 = .90$; $\$600 \times .90 = \$540$ Ans.
9. $\$1.00 - .03 = .97$; $\$1000 \div .97 = \$1030.92.7+$.
   $\$1.00 - .05 = .95$; $\$1030.92.7 \div .95 = \$1085.18.7+$.
   $\$1.00 - .06 = .94$; $\$1085.18.7 \div .94 = \$1154.45.4+$.
   $\$1.00 - .07 = .93$; $\$1154.45.4 \div .93 = \$1241.34.8+$.
   Ans.

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SECTION XXXVII.

BANKING.

1. (p. 153.) $\$476 \times .005\frac{1}{2} = \$2.61.8$ Ans.
2. $\$1000 \times .010\frac{1}{2} = \$10.50$ Ans.
3. $\$7800 \times .015\frac{1}{2} = \$120.90$ Ans.
4. $\$8000 \times .010\frac{1}{2} = \$84.00$ Ans.
5. $\$760 \times .025\frac{1}{2} = \$19.38$; $\$760 - \$19.38 = \$740.62$ Ans.
6. $\$1728 \times .15\frac{1}{2} = \$26.78.4$; $\$1728 - \$26.78.4 = \$1701.21.6$ Ans.
7. $\$7860 \times .030\frac{1}{2} = \$239.73$; $\$7860 - \$239.73 = \$7620.27$ Ans.
8. $\$3.50 \times 450 = \$1575$ price for which the fish were bought.

   $\$4.00 \times 450 = \$1800$ price for which they were sold.

   $\$1800 \times .030\frac{1}{2} = \$54.90$; $\$1800 - \$54.90 = \$1745.10$ received at the bank.

   $\$1745.10 - \$1575 = \$170.10$ gain on the fish, Ans.

SECTION XXXVIII.

BARTER.

1. (p. 154.) $760 \times 8 = 6080 \div 12\frac{1}{2} = 486\frac{2}{5}$lb. Ans.
2. $760 \times 62\frac{1}{2} = 47500 \div 17 = 2794\frac{2}{17}$lb. Ans.
3. $3 \times 63 \times 1.10 = 20790 \div 126 = \$1.65$. Ans.
4. $12 \times 112 \times 8 = 10752 \div 196 = 54\frac{8}{7}$lb. Ans.
5. 17cwt. 3qr. 4lb. $= 1992$; $41 \times 6.70 = \$274.70 - \$80 = \$186.70 \div 1992 = \$0.09\frac{371}{996}$ Ans.

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6. B's tea cost him 40 cents per lb., and he sells it for 50 cents per lb.; his gain, therefore, is $\frac{1}{4}$ of the principal, or 25 per cent. A's gain is 4 cents on the lb., and his gain, to be in proportion to B's, must be $\frac{1}{4}$ of the principal; A's sugar, therefore, will be $4 \times 4 = 16$ cents per lb. Ans.

7. $15 \times 63 \times 1.25 = \$1181.25 \div 25 = 47\frac{1}{4}$M. staves, Ans.

8. As Q bought his oats for 35 cents per bushel, and sold them at 50 cents, his gain per cent. is $50 - 35 = 15$; $\frac{15}{35} = \frac{3}{7}$ of the cost. If, therefore, we add $\frac{3}{7}$ of the cost of Z's flour to \$5.00, we have his bartering price; thus, $\frac{3}{7}$ of $\$5.00 = \$2.14\frac{2}{7}$, $\$2.14\frac{2}{7} + \$5.00 = \$7.14\frac{2}{7}$ per barrel; and $670 \times .50 = \$335 \div \$7.14\frac{2}{7} = 46\frac{9}{10}$ barrels of flour, Ans.

SECTION XXXIX.

COMPOUND INTEREST.

(p. 155.)

13.

Principal, bearing interest from Jan. 1, 1830,		\$500.00.0
Compound interest on \$500 from Jan. 1, 1830, to Sept. 1, 1834, 4y. 8mo.		156.48.7
Amount of the principal to Sept. 1, 1834, . . .		656.48.7
First payment, July 16, 1830, . . .	200.00.0	
Compound interest from July 16, 1830, to Sept. 1, 1834, 4y. 1mo. 15da. .	54.38.8	
Second payment, Aug. 21, 1831, . .	200.00.0	
Compound interest from Aug. 21, 1831, to Sept. 1, 1834, 3y. 0mo. 10da. . .	38.59.9	
Amounts carried forward,	\$492.98.7	\$656.48.7

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Amounts brought forward,	$492.98.7	$656.48.7
Third payment, Dec. 1, 1832, . .	100.00.0	
Compound interest from Dec. 1, 1832, to Sept. 1, 1834, 1y. 9mo. . . .	10.77.0	
Amount of the endorsements, ...		603.75.7
Balance due Sept. 1, 1834, ...		$52.73.0

14.

Principal, bearing interest from March 25, 1833,		$100.00.0
Interest for 1y. 5mo.		8.65.0
Amount of the principal to Aug. 25, 1835, . .		108.65.0
First payment, June 11, 1834, . . .	50.00.0	
Compound interest from June 11, 1834, to Aug. 25, 1835, 14mo. 14da. . .	3.65.3	
Second payment, Sept. 25, 1834, . .	50.00.0	
Compound interest from Sept. 25, 1834, to Aug. 25, 1835, 11mo.	2.75.0	
Amount of the endorsements, ...		106.40.3
Balance due Aug. 25, 1835, ...		$2.24.7

SECTION XL.

PRACTICE.

(p. 160.)

6.

6d. = ½) 387s. 0d. = price at 1s.

3d. = ½) 193 6 = price at 6d.
96 9 = price at 3d.

20) 290 3

Ans. 14£. 10s. 3d. = price at 9d.

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7.

2s. 6d. = $\frac{1}{8}$) 490£. 0s. 0d. = value at 1£. per lb.

Ans. 61£. 5s. 0d. = value at 2s. 6d.

8.

4s. = $\frac{1}{5}$) 384£. value at 1£. per yd.

6d. = $\frac{1}{8}$)	76	16	0	= value at 4s.
3d. = $\frac{1}{2}$)	9	12	0	= value at 6d.
	4	16	0	= value at 3d.

Ans. 91£. 4s. 0d. = value at 4s. 9d.

9.

10s. = $\frac{1}{2}$) 714£. value at 1£. per yd.

5s. = $\frac{1}{2}$)	357	00	= value at 10s.
6d. = $\frac{1}{10}$)	178	10	= value at 5s.
	17	17	= value at 6d.

Ans. 553£. 7s. = value at 15s. 6d.

10.

2qr. = $\frac{1}{2}$)	$2.50	= value of 1cwt.
	16	
	40.00	= value of 16cwt.
1qr. = $\frac{1}{2}$)	1.25	= value of 2qr.
7lb. = $\frac{1}{4}$)	.62.5	= value of 1qr.
2lb. = $\frac{1}{14}$)	.15.62	= value of 7lb.
1lb. = $\frac{1}{2}$)	4.49	= value of 2lb.
	2.24	= value of 1lb.

Ans. 42.09.8 + = value of 16cwt. 3qr. 10lb.

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11.

1qr. = ¼) $14 = value of 1cwt.
27

378 = value of 27cwt.
14lb. = ½) 3.50 = value of 1qr.
7lb. = ½) 1.75 = value of 14lb.
87½ = value of 7lb.

Ans. $384.12½ = value of 27cwt. 1qr. 21lb.

12.

10cwt. = 1/7) $24.60 = value of 1 ton.
7

172.20 = value of 7 tons.
2cwt. = ⅕) 12.30 = value of 10cwt.
1cwt. = ½) 2.46 = value of 2cwt.
2qr. = ½) 1.23 = value of 1cwt.
7lb. = ⅛) .61.5 = value of 2qr.
7.6⅞ = value of 7lb.

Ans. $188.88.1⅞ = value of 7T. 13cwt. 2qr. 7lb.

13.

2R. = ½) $80.50 = value of 1 acre.
25

2012.50 = value of 25 acres.
20rd. = ¼) 40.25 = value of 2 roods.
10rd. = ½) 10.06.2½ = value of 20 rods.
5rd. = ½) 5.03.1¼ = value of 10 rods.
2.51.5⅝ = value of 5 rods.

Ans. $2070.35.9⅜ = value of 25A. 2R. 35rd.

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14.

10rd. = $\frac{1}{16}$) $32.32 = value of 1A.
51
3232
16160
$1648.32 = value of 51A.
5rd. = $\frac{1}{2}$) 2.02 = value of 10rd.
1.01 = value of 5rd.
Ans. $1651.35 = value of 51A. 0R. 15rd.

15.

2qr. = $\frac{1}{2}$) $5.60 = value of 1yd.
7
39.20 = value of 7yd.
1qr. = $\frac{1}{2}$) 2.80 = value of 2qr.
2na. = $\frac{1}{2}$) 1.40 = value of 1qr.
.70 = value of 2na.
Ans. $44.10 = value of 7yd. 3qr. 2na.

16.

10 = $\frac{1}{10}$) $6780 = principal.
$2\frac{1}{2}$ = $\frac{1}{4}$) 678 = 10 per cent.
169.50 = $2\frac{1}{2}$ per cent.
Ans. $847.50 = $12\frac{1}{2}$ per cent.

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17.

5 per cent. $= \frac{1}{20}$) $1728.00 = principal.

1 per cent. $= \frac{1}{5}$) 86.40 = interest at 5 per cent.
17.28 = interest at 1 per cent.

6 months $= \frac{1}{2}$) 103.68 = interest at 6 per cent.
5

518.40 = interest for 5 years.
1 month $= \frac{1}{6}$) 51.84 = interest for 6 months.
15 days $= \frac{1}{2}$) 8.64 = interest for 1 month.
5 days $= \frac{1}{3}$) 4.32 = interest for 15 days.
1.44 = interest for 5 days.

Ans. $584.64 = interest for 5y. 7mo. 20da.

18.

10cwt. $= \frac{1}{2}$) 19£. 19s. $11\frac{3}{4}$d. = value of 1 ton.
19

379 19 $7\frac{1}{4}$ = value of 19 tons.
5cwt. $= \frac{1}{2}$) 9 19 $11\frac{7}{8}$ = value of 10cwt.
4cwt. $= \frac{1}{5}$) 4 19 $11\frac{15}{16}$ = value of 5cwt.
2qr. $= \frac{1}{8}$) 3 19 $11\frac{18}{20}$ = value of 4cwt.
1qr. $= \frac{1}{2}$) 0 9 $11\frac{158}{160}$ = value of 2qr.
14lb. $= \frac{1}{2}$) 0 4 $11\frac{319}{320}$ = value of 1qr.
7lb. $= \frac{1}{2}$) 0 2 $5\frac{638}{640}$ = value of 14lb.
4lb. $= \frac{1}{7}$) 0 1 $2\frac{1278}{1280}$ = value of 7lb.
2lb. $= \frac{1}{2}$) 0 0 $8\frac{1278}{2240}$ = value of 4lb.
$\frac{1}{2}$lb. $= \frac{1}{4}$) 0 0 $4\frac{1278}{4480}$ = value of 2lb.
0 0 $1\frac{1278}{17920}$ = value of $\frac{1}{2}$lb.

Ans. 399£. 19s. $5\frac{1664}{17920}$d. = value of 19T. 19cwt. 3qr. $27\frac{1}{2}$lb.

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SECTION XLI.

EQUATION OF PAYMENTS.

2. (p. 162.) \$50 to be paid in 2 months, is the same as \$100 in 1 month; \$150 in 8 months, is the same as \$100 in 12 months. The equated time, then, will be, as if \$100 were to be paid in 1 month, \$100 in 5 months, and \$100 in 12 months; that is, \$100 in $1+5+12=18$ months; consequently \$300 in $\frac{1}{3}$ of 18 months $=6$ months, Ans.

OPERATION.

$$\begin{array}{rl}
\$\ 50 \times 2 = & 100 \\
\$100 \times 5 = & 500 \\
\$150 \times 8 = & 1200 \\
\hline
\$300 \quad 300\ ) & 1800\ (\ 6 \text{ months, Ans.} \\
 & 1800 \\
\hline
\end{array}$$

3. \$200 to be paid in 3 months, is the same as \$100 in 6 months; and \$300 in 5 months, is the same as \$100 in 15 months; and \$500 in 10 months, is the same as \$100 in 50 months. If, then, \$100 is to be paid in $6+15+50=71$ months, \$1000 should be paid in $\frac{1}{10}$ of 71 months $=\frac{71}{10}=$ 7mo. 3da. Ans.

OPERATION.

$$\begin{array}{rl}
\$\ 200 \times 3 = & 600 \\
\$\ 300 \times 5 = & 1500 \\
\$\ 500 \times 10 = & 5000 \\
\hline
\$1000 \quad 1000\ ) & 7100\ (7\tfrac{1}{10} \text{ months, Ans.} \\
 & 7000 \\
\hline
 & 100
\end{array}$$

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4. $50 for 4 months, is $1 for 200 months; and $100 for 8 months, is $1 for 800 months. If, then, $1 is to be paid in $200 + 800 = 1000$ months, $150 should be paid in $\frac{1}{1000}$ of 1000 months $= \frac{1000}{150} = 6\frac{2}{3}$ months. It appears, then, that $150 is paid $6\frac{2}{3}$ months before it is due. The question now is, In how much *less* than 10 months should the $250 be paid? As we have before shown that $1 is to be paid in 1000 months, $250 should be paid in $\frac{1}{250}$ of 1000 months $= 1000 \div 250 = 4$ months. We find, then, that the time in which B is to pay A, is 4 months *less* than it otherwise would have been, on account of A's making present payment. We therefore subtract 4 months from 10, and find the true answer; thus, $10 - 4 = 6$ months, Ans.

OPERATION.

$$\begin{array}{rl} 50 \times 4 = 200 & \\ 100 \times 8 = 800 & \\ \hline 150 \quad 150\,) & 1000\ (\ 6\frac{2}{3} \text{ months.} \\ & 1000 \\ & \hline \end{array}$$

$150 \times 6\frac{2}{3} = 1000 \div 250 = 4$ months;
$10 - 4 = 6$ months, Ans.

5. As $\frac{1}{2}$ of $144 is paid 7 months before it is due, it is evident the remainder, $72, is payable in 14 months; but $48 of this sum is paid in 4 months, which is 10 months before it is due. There will then remain $24 unpaid; and the question will be, How long may $24 be kept to pay the interest of $72 for 10 months? $72 for 10 months, is the same as $1 for 720 months; and $1 for 720 months, is the same as $24 for $\frac{1}{24}$ of 720 months $= 720 \div 24 = 30$ months. To the 30 months we add the 4 months, and we have the whole equated time; thus, $30 + 4 = 34$ months $=$ 2y. 10mo. Ans

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OPERATION.

$$\begin{array}{lll}
144 \times 7 = 1008 & & \\
\hline
72 & & \\
48 \times 4 = 192 & & \\
\hline
120 & 24\,)\,816\,(\,34\text{mo.} = 2\text{y. } 10\text{mo. Ans.} & \\
\hline
24 & 72 & \\
 & \overline{96} & \\
 & 96 & \\
 & \overline{96} &
\end{array}$$

6. \$$133\frac{1}{3}$ in 2 months, is the same as \$1 in $266\frac{2}{3}$ months; and \$$266\frac{2}{3}$ in 3 months, is the same as \$1 in 800 months; \$400 in 6 months, is the same as \$1 in 2400 months; and \$1 in $266\frac{2}{3} + 800 + 2400 = 3466\frac{2}{3}$ months, is the same as \$800 for $\frac{1}{800}$ of $3466\frac{2}{3}$ months $= 3466\frac{2}{3} \div 800 = 4\frac{1}{3}$ months. And if $\frac{1}{2}$ of \$800 be paid down, the remainder, \$400, may be kept twice $4\frac{1}{3}$ months $= 8\frac{2}{3}$ months, Ans.

OPERATION.

$$\begin{array}{lll}
\$133\frac{1}{3} \times 2 = & 266\frac{2}{3} & \\
266\frac{2}{3} \times 3 = & 800 & \\
400 \times 6 = & 2400 & \\
\hline
800 & 400\,)\,3466\frac{2}{3}\,(\,8 \text{ months.} & \\
400 & 3200 & \\
\hline
400 & 266\frac{2}{3} & \\
 & 30 & \\
 & \overline{8000}\,(\,20 \text{ days.} & \\
 & 800 & \\
 & \overline{0} &
\end{array}$$

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8. The various parcels of goods will become due as follows:—

May 1, a bill amounting to $600.
July 7, " " " $370.
July 15, " " " $560.
Oct. 20, " " " $420.

OPERATION.

$$
\begin{array}{rrrr}
\$600 \times & 0 = & & \\
370 \times & 67 = & 24790 & \\
560 \times & 75 = & 42000 & \\
420 \times & 172 = & 72240 & \\
\hline
\$1950 & 1950) & 139030 & (71\tfrac{580}{1950} \text{ Ans.} \\
 & & 13650 & \\
\hline
 & & 2530 & \\
 & & 1950 & \\
\hline
 & & 580 &
\end{array}
$$

The medium time of payment will therefore be $71\frac{580}{1950}$ days, that is, 72 days from May 1, which will be July 11.

NOTE.—Merchants generally prefer the following method:

$$
\begin{array}{rrrr}
\$600 \times & 0 & & \\
370 \times & 2\frac{6}{30} = & 814 & \\
560 \times & 2\frac{14}{30} = & 1381\frac{1}{3} & \\
420 \times & 5\frac{12}{30} = & 2366 & \\
\hline
\$1950 & 1950) & 4561\frac{1}{3} & (2\text{mo. } 10\tfrac{334}{1950}\text{da. Ans.}
\end{array}
$$

5

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SECTION XLII.

AMERICAN DUTIES.

(p. 169.)

6.

1276
1280
1178
1378
1570
1338
8020
42 draft.
7978
957 tare.
7021 net.
$2\frac{1}{2}$
14042
35105
$175.52.5 Ans.

7.

986£.
40
9) 39440
$4382.22
.44
1752888
1752888
$1928.17.6.8 Ans.

8.

176
145
128
148
150
747
20 wants.
727
15 leakage.
712
.15
3560
712
$106.80 Ans.

9.

270 tons.
30
$8100 Ans.

10.

$7890 \times .01\frac{3}{4} = 138.07$
$7890 - .138 = 7752$
$7752 \times .04 = \$310.08$ Ans.

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11.

$450 \times 10 = 4500$lb.
40 draft.

4460
357 = 8 per cent.

4103
.04

$164.12 Ans.

SECTION XLIV.

PROPORTION.

32. (p. 175.) BY ANALYSIS.

If $\frac{1}{2}$yd. cost $\frac{3}{5}$£., 1yd. will cost $\frac{6}{5}$£., and $\frac{1}{8}$yd. will cost $\frac{1}{8} \times \frac{6}{5} = \frac{6}{40} = \frac{3}{20}$£.; and $\frac{7}{8}$ will cost 7 times $\frac{3}{20}$£. $= \frac{7}{1} \times \frac{3}{20} = \frac{21}{20} = 1$£. 1s. 0d. Ans.

STATEMENT.

$\frac{1}{2}$yd. : $\frac{7}{8}$yd. : : $\frac{3}{5}$£. $= \frac{3}{1} \times \frac{7}{8} \times \frac{3}{5} = \frac{63}{40} = \frac{21}{20}$£. $= 1$£. 1s. 0d. Ans.

33. BY ANALYSIS.

In $4\frac{1}{2}$yd. are 9 halves; in $13\frac{1}{2}$yd. are 27 halves. If, therefore, 9 halves cost $9.75, 1 half will cost $\frac{1}{9}$ of $9.75 = $\frac{9.75}{9}$, and 27 halves will cost 27 times $\frac{9.75}{9} = \frac{27}{1} \times \frac{9.75}{9} =$ $29.25 Ans.

FORM OF STATEMENT.

$4\frac{1}{2}$yd. : $13\frac{1}{2}$yd. : : $9.75 : $29.25 Ans.

OPERATION.

$\frac{2}{9} \times \frac{27}{2} \times \frac{9.75}{1} = \frac{526.50}{18} =$ $29.25 Ans.

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34. BY ANALYSIS.

If it be 1in. wide, the length must be 144in.; and if it be $2\frac{1}{2}$in., it will be $144 \div 2\frac{1}{2} = 57\frac{3}{5}$in. Ans.

FORM OF STATEMENT.

$2\frac{1}{2}$in. : 1in. : : 144in. : $57\frac{3}{5}$in. Ans.

35. BY ANALYSIS.

If $\frac{7}{16}$ cost 51£., $\frac{1}{16}$ will cost $\frac{51}{7}$; and $\frac{16}{16}$, or the whole ship, will cost 16 times $\frac{51}{7}$£. $= \frac{16}{1} \times \frac{51}{7} = \frac{816}{7}$£.; $\frac{1}{32}$ of $\frac{816}{7} = \frac{1}{32} \times \frac{816}{7} = \frac{816}{224} = \frac{51}{14}$; and $\frac{3}{32}$ will cost 3 times $\frac{51}{14} = \frac{3}{1} \times \frac{51}{14} = \frac{153}{14}$£. $= 10$£. 18s. $6\frac{6}{7}$d. Ans.

FORM OF STATEMENT.

$\frac{7}{16} : \frac{3}{32}$: : 51£. : 10£. 18s. $6\frac{6}{7}$d. Ans.

OPERATION.

$\frac{16}{7} \times \frac{3}{32} \times \frac{51}{1} = 10$£. 18s. $6\frac{6}{7}$d. Ans.

36. BY ANALYSIS.

If 5yd. cost \$7, 1yd. cost \$$\frac{7}{5}$; and if 7yd. sold for \$11, 1yd. sold for \$$\frac{11}{7}$; therefore $\frac{11}{7} - \frac{7}{5} =$ \$$\frac{8}{35}$ were gained on each yard. And as \$200 were gained, there must have been $200 \div \frac{8}{35} = 1166\frac{2}{3}$yd.; and $1166\frac{2}{3} \div 129\frac{17}{27} = 9$ bales, Ans.

FORM OF STATEMENT.

5yd. : 1yd. : : \$7 : \$$\frac{7}{5}$; 7yd. : 1yd. : : \$11 : \$$\frac{11}{7}$; $\frac{11}{7} - \frac{7}{5} =$ \$$\frac{8}{35}$;
\$$\frac{8}{35}$: \$200 : : 1yd. : $1166\frac{2}{3}$yd.;
$129\frac{17}{27}$yd. : $1166\frac{2}{3}$yd. : : 1 bale : 9 bales, Ans.

37. $13° 10' 35'' : 360° : : 24h. : 27da. 7h. 43m. +$ Ans.

38. BY ANALYSIS.

If 7lb. cost \$$\frac{3}{4}$, 1lb. will cost $\frac{1}{7} \times \frac{3}{4} =$ \$$\frac{3}{28}$; and 12lb. will cost $\frac{12}{1} \times \frac{3}{28} =$ \$$\frac{36}{28} =$ \$$1.28\frac{4}{7}$ Ans.

FORM OF STATEMENT.

7lb. : 12lb. : : \$$\frac{3}{4}$: \$$1.28\frac{4}{7}$ Ans.

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39. BY ANALYSIS.

If 7lb. cost $1.75, 1lb. will cost $\frac{175}{7} = \$0.25$; and if 25 cents buy 1lb., $213.50 will buy as many pounds as this sum contains 25 cents; thus, $213.50 ÷ .25 = 854lb. = 7cwt. 2qr. 14lb. Ans.

FORM OF STATEMENT.

$1.75 : $213.50 :: 7lb. : 854lb. = 7cwt. 2qr. 14lb. Ans.

40. BY ANALYSIS.

If 7oz. of gold is worth 30£., 1oz. is worth $\frac{30}{7}$£.; and 7lb. 11oz. = 95oz. is worth $\frac{95}{1} \times \frac{30}{7} = \frac{2850}{7}$£. = 407£. 2s. $10\frac{2}{7}$d. Ans.

FORM OF STATEMENT.

7oz. : 7lb. 11oz. :: 30£. : 407£. 2s. $10\frac{2}{7}$d. Ans.

41. BY ANALYSIS.

$500 for 6 months, is the same as $3000 for 1 month; and if $3000 give 1 month, $600 will give $3000 ÷ $600 = 5 months, Ans.

FORM OF STATEMENT.

$600 : $500 :: 6m. : 5m. Ans.

42. BY ANALYSIS.

If $8 give 7 oz., $1 would give 56oz., and $7\frac{1}{2}$ would give $56 \div 7\frac{1}{2} = 7\frac{7}{15}$oz. Ans.

FORM OF STATEMENT.

$7.50 : $8.00 :: 7oz. : $7\frac{7}{15}$oz. Ans.

43. BY ANALYSIS.

Each suit would contain $3\frac{3}{4} \times 1\frac{7}{8} = \frac{225}{32}$ square yards; and to clothe the regiment, it would require $\frac{1000}{1} \times \frac{225}{32} = \frac{225000}{32} = 7031\frac{1}{4}$yd. To line this cloth, it would require 7031.25 ÷ 1.25 = 5625yd. Ans.

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FORM OF STATEMENT.

1 man : 1000 men :: $3\frac{3}{4} \times 1\frac{7}{8} = 2\frac{3}{32}\frac{5}{}$yd. : 7031$\frac{1}{4}$yd.;
$1\frac{1}{4}$yd. : 1yd. :: 7031$\frac{1}{4}$yd. : 5625yd. Ans.

44. BY ANALYSIS.

If $9\frac{5}{7}$yd. cost \$11$\frac{3}{5}$, 1yd. will cost $11\frac{3}{5} \div 9\frac{5}{7} = \$1\frac{33}{170}$;
$16\frac{16}{203}$E. $= 20\frac{20}{203}$yd.; and if 1yd. cost \$$1\frac{33}{170}$, $20\frac{20}{203}$yd. will cost $20\frac{20}{203} \times 1\frac{33}{170} =$ \$24 Ans.

FORM OF STATEMENT.

$9\frac{5}{7}$yd. : $16\frac{16}{203}$EE. $= 20\frac{20}{203}$yd. :: \$11$\frac{3}{5}$: \$24 Ans.

45. BY ANALYSIS.

If for \$17280 there be received \$15120 only, for \$1 there will be received $17280 \div 15120 =$ \$0.87$\frac{1}{2}$. A will, therefore, receive $\$5670 \times .87\frac{1}{2} =$ \$4961.25 Ans.

FORM OF STATEMENT.

\$17280 : \$15120 :: \$1 : \$0.87$\frac{1}{2}$;
\$1 : \$0.87$\frac{1}{2}$ :: \$5670 : \$4961.25 Ans.

46. BY ANALYSIS.

49 guineas $= 49 \times 28 = 1372$s.; and, if 57yd. cost 1372s., 1yd. will cost $1372 \div 57 = 24\frac{4}{57}$s.; $\frac{1}{4}$ of which is $6\frac{1}{57}$s. = price of 1qr. An ell English will cost 5 times as much; $6\frac{1}{57} \times 5 = 30\frac{5}{57}$s. $= 1£$. 10s. $1\frac{1}{19}$d. Ans.

FORM OF STATEMENT.

57yd. : 1EE. :: 49guin. : 1£. 10s. $1\frac{1}{19}$d. Ans.

47. BY ANALYSIS.

If \$1.15 buy 1gal., \$100 will buy $100 \div 1.15 = 86$gal. 3qt. $1\frac{15}{23}$pt. Ans.

FORM OF STATEMENT.

\$1.15 : \$100 :: 1gal. : 86gal. 3qt. $1\frac{15}{23}$pt. Ans.

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48. BY ANALYSIS.

If 9 packages cost $34560, 1 package will cost $34560 \div 9 = \$3840$; and if 1 parcel cost $\$3840 \div 8 = \$480$, 1 piece will cost $\$480 \div 12 = \$40$, and 1yd. will cost $\$40 \div 20 = \$2.00$ Ans.

FORM OF STATEMENT.

9pack. : 1pack. : : $34560 : $3840;
8par. : 1par. : : $3840 : $480; 12pieces : 1 piece : : $480 : $40;
20yd. : 1yd. : : $50 : $2.00 Ans.

49. BY ANALYSIS.

If 75 gallons run into the cistern, and 40 gallons run out per hour, there is left in the cistern 35 gallons; and if 35 gallons give 1 hour, 500 gallons will give $500 \div 35 =$ 14h. 17m. $8\frac{4}{7}$sec. Ans.

FORM OF STATEMENT.

75gal. $-$ 40gal. $=$ 35gal.;
35gal. : 500gal. : : 1h. : 14h. 17m. $8\frac{4}{7}$sec. Ans.

50. BY ANALYSIS.

If one pair may be bought for $0.56, then for $120.96 may be had $12096 \div 56 = 216$ pair $=$ 18doz. Ans.

FORM OF STATEMENT.

$0.56 : $120.96 : : 1 pair : 216 pair $=$ 18doz. Ans.

51. BY ANALYSIS.

If the first pipe will empty the cistern in 20 minutes, in 1 minute $\frac{1}{20}$ of it will be emptied. The second pipe will empty $\frac{1}{40}$ of it in 1 minute. The third pipe will empty $\frac{1}{75}$ of it in a minute. Therefore in 1 minute $\frac{1}{20} + \frac{1}{40} + \frac{1}{75} = \frac{53}{600}$ of the cistern will be emptied. And, if $\frac{53}{600}$ of the cistern be emptied in 1 minute, the whole will be emptied in $600 - 53 =$ 11h. $19\frac{13}{53}$m. Ans.

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FORM OF STATEMENT.

20m. : 1m. :: 1cist. : $\frac{1}{20}$
40m. : 1m. :: 1cist. : $\frac{1}{40}$
75m. : 1m. :: 1cist. : $\frac{1}{75}$

$\frac{53}{600}$

$\frac{53}{600}$cist. : 1cist. :: 1m. : 11m. 19$\frac{13}{53}$sec. Ans.

52. BY ANALYSIS.

If A can mow the field in 5 days, in 1 day he will mow $\frac{1}{5}$ of it. B in 1 day will mow $\frac{1}{6}$ of the field. Therefore A and B will, in one day, mow $\frac{1}{5} + \frac{1}{6} = \frac{11}{30}$ of the field; and it will require $30 \div 11 = 2\frac{8}{11}$ days to mow the whole field, Ans.

FORM OF STATEMENT.

5da. : 1da. :: 1 field : $\frac{1}{5}$; 6da. : 1da. :: 1 field : $\frac{1}{6}$;
$\frac{1}{5} + \frac{1}{6} = \frac{11}{30}$ field : 1 field :: 1 da. : $2\frac{8}{11}$da. Ans.

53. BY ANALYSIS.

To raise the wall 8 feet, it required the labor of 6 men 12 days; that is, the labor of 72 men 1 day; and to raise it 1 foot, it would take $\frac{1}{8}$ of 72 men $= 72 \div 8 = 9$ men; and to raise it the remaining $32 - 8 = 24$ feet in one day, it must require 24 times 9 men; $24 \times 9 = 216$ men. But as they have 6 days to perform the labor, it will take only $\frac{1}{6}$ of their number, $216 \div 6 = 36$ men. Ans.

FORM OF STATEMENT.

8 feet : 24 feet :: 6 men : 18 men.
Then 6 days : 12 days :: 18 men : 36 men, Ans.

54. BY ANALYSIS.

A can do $\frac{1}{20}$ of the labor in 1 day, and A and C can do $\frac{1}{12}$ of it; therefore C alone can do only $\frac{1}{12} - \frac{1}{20} = \frac{1}{30}$ of

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it. It will therefore take him 30 days to build the boat alone, Ans.

FORM OF STATEMENT.

$\frac{1}{12} - \frac{1}{20} = \frac{1}{30} : 1 :: 1$ day : 30 days, Ans.

55. BY ANALYSIS.

If 700 men are provided with 184000lb., there are for each man $184000 \div 700 = 262\frac{6}{7}$lb. And if each person consume 5lb. per week, he will have sufficient to last him $262\frac{6}{7} \div 5 = 52\frac{4}{7}$ weeks $= 52$ weeks 4 days, Ans.

FORM OF STATEMENT.

700 men : 1 man :: 184000lb. : $262\frac{6}{7}$lb.

Then 5lb. : $262\frac{6}{7}$lb. :: 1 week : 52 weeks 4 days, Ans.

56. BY ANALYSIS.

Each man has $3 \times \frac{3}{4} = \frac{9}{4}$lb. of beef per week, and 25 men have $25 \times \frac{9}{4} = 56\frac{1}{4}$lb. If, then, $56\frac{1}{4}$lb. last 1 week, 3150lb. will last $3150 \div 56\frac{1}{4} = 56$ weeks, Ans.

FORM OF STATEMENT.

$\frac{9}{4} \times 3 \times 25 = 56\frac{1}{4}$lb. : 3150lb. :: 1 week : 56 weeks, Ans.

57. BY ANALYSIS.

The floor contains $20 \times 16 = 320$ square feet; and $320 \times 144 = 46080$ square inches. The tiles contain $8 \times 8 = 64$ square inches each; and it will therefore require $46080 \div 64 = 720$ tiles, Ans.

FORM OF STATEMENT.

$8 \times 8 = 64$in. : $20 \times 16 \times 144 = 46080$in. :: 1 tile : 720 tiles, Ans.

58. FORM OF STATEMENT.

$10 \times 9 \times 4 = 360$ cubic inches in each stone.

$80 \times 20 \times 2\frac{1}{4} \times 1728 = 6220800$ cubic inches in the wall.

360in. : 6220800in. :: 1 stone : 17280 stones, Ans.

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59. FORM OF STATEMENT.

$3.00 × 60 = $180, price given for the Holland.
$4.00 × 60 = $240, price obtained for it.
$180 : $240 :: $240 : $320 Ans.

60. BY ANALYSIS.

27 × 7 = 189 = miles A is ahead of B.

36 — 27 = 9 miles that B gains each day on A. If, therefore, 9 miles are gained in one day, it will require, to gain 189 miles, 189 ÷ 9 = 21 days, Ans.

FORM OF STATEMENT.

36 — 27 = 9m. : 189m. :: 1 day : 21 days, Ans.

61. BY ANALYSIS.

2s. 3d. = 27d., price obtained for the coffee. It is evident that 27d. is $\frac{135}{100}$ of the cost; therefore $\frac{100}{135}$ × 27d. = 20d. was the cost, Ans.

FORM OF STATEMENT.

135d. : 100d. :: 27d. : 20d. Ans.

62. FORM OF STATEMENT.

2000 × 12 × 7 × 14 = 2352000 ÷ 16 = 147000lb. whole quantity.
105 × 200 = 21000lb. wholly spoiled.
147000 — 21000 = 126000oz. left to subsist on.
2000 × 12 × 7 = 168000 rations.
2016000 ÷ 168000 = 12oz. for each man per day, Ans.

63. FORM OF STATEMENT.

2000 × 12 × 7 × 12 = 2016000 ÷ 16 = 126000lb. quantity subsisted on.
126000 ÷ 6 = 21000lb. spoiled.
21000 × 7 = 147000lb. the whole quantity, Ans.

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64. FORM OF STATEMENT.

$2000 \times 12 \times 7 \times 14 = 2352000 \div 16 = 147000$lb. whole weight.

$2000 \times 12 \times 7 \times 12 = 2016000 \div 16 = 126000$lb. left to subsist on, Ans.

65. FORM OF STATEMENT.

$2000 \times 12 \times 7 \times 12 = 2016000 \div 16 = 126000$lb.

$126000 \div 6 = 21000 =$ quantity lost.

$21000 \times 7 = 147000$lb. whole quantity.

$147000 \times 16 = 2352000 \div \overline{2000 \times 12 \times 7} = 14$oz. Ans.

66. FORM OF STATEMENT.

.85gal. : .25gal. : : $2.72 : $0.80 Ans.

67. FORM OF STATEMENT.

61.3lb. : 1lb. : : $44.9942 : $0.73.4 Ans.

68. FORM OF STATEMENT.

.15hhd. : 1hhd. : : $2.39 : $0.35.85 Ans.

69. FORM OF STATEMENT.

.75 ton : 1 ton : : $15 : $20.00 Ans.

70. FORM OF STATEMENT.

.5yd. : 6yd. : : 10yd. : 120yd. Ans.

71. FORM OF STATEMENT.

10h. : 12h. : : 15 days : 18 days, Ans.

72. FORM OF STATEMENT.

9m. : 5m. : : 450 men : 250 men; 450—250=200 men, Ans.

73. BY ANALYSIS.

As the hour hand and minute hand pass each other 11 times in 12 hours, and as they are together at 12 o'clock,

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it is evident that they will next pass each other in $\frac{1}{11}$ of 12 hours = 1h. 5m. $27\frac{3}{11}$sec. Ans.

FORM OF STATEMENT.

11h. : 12h. :: 1h. : 1h. 5m. $27\frac{3}{11}$sec. Ans.

74. BY ANALYSIS.

If A and B can perform a piece of labor in $5\frac{5}{11}$ days, it is evident, that in 1 day they would do $\frac{1}{5\frac{5}{11}} = \frac{11}{60}$ of the work. If B and C can do the work in $6\frac{2}{3}$ days, in 1 day they would perform $\frac{1}{6\frac{1}{2}} = \frac{3}{20}$ of the work. If A and C can do the work in 6 days, in 1 day they would perform $\frac{1}{6}$ of it. It then appears, that A, B, and C, by laboring each 2 days, will perform $\frac{11}{60} + \frac{3}{20} + \frac{1}{6} = \frac{30}{60} = \frac{1}{2}$ of the work; and, therefore, by laboring 1 day each, they would do $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{4}$ of it. And if $\frac{1}{4}$ of the labor be performed in 1 day, it is evident that the whole work will be performed in 4 days, Ans.

If A, B, and C, can do $\frac{1}{4}$ of the work in one day, and A and B can do $\frac{11}{60}$, it is evident that C can do $\frac{1}{4} - \frac{11}{60} = \frac{4}{60} = \frac{1}{15}$ of it in 1 day, and therefore will be 15 days in performing the whole. B and C can do $\frac{3}{20}$ of it in a day; therefore A can do $\frac{1}{4} - \frac{3}{20} = \frac{1}{10}$ of it in a day, or he will be 10 days in doing the whole. A and C can do $\frac{1}{6}$ of the work in a day; therefore B can do $\frac{1}{4} - \frac{1}{6} = \frac{1}{12}$ in a day, or, in performing the whole labor, he will be 12 days, Ans.

FORM OF STATEMENT.

$5\frac{5}{11}$ days : 1 day :: 1 work : $\frac{11}{60}$ work = A and B.
$6\frac{2}{3}$ days : 1 day :: 1 work : $\frac{3}{20}$ work = B and C.
6 days : 1 day :: 1 work : $\frac{1}{6}$ work = A and C.

$\frac{1}{2}$ work = 2 A, 2 B, 2 C =
$\frac{1}{4}$ work = A, B, and C.

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$\frac{1}{4} - \frac{11}{60} = \frac{1}{15}$ work : 1 work : : 1 day : 15 days = C.
$\frac{1}{4} - \frac{3}{20} = \frac{1}{10}$ work : 1 work : : 1 day : 10 days = A.
$\frac{1}{4} - \frac{1}{6} = \frac{1}{12}$ work : 1 work : : 1 day : 12 days = B.
$\frac{1}{4}$ work : 1 work : : 1 day : 4 days = A, B, and C.

SECTION XLV.

COMPOUND PROPORTION.

(p. 181.)

3.

$$\left.\begin{array}{l} \$100 : \$500 \\ 12\text{mo.} : 4\text{mo.} \end{array}\right\} :: \$6 : \$10 \text{ Ans.}$$

4.

$$\left.\begin{array}{l} \$6 : \$10 \\ 4\text{mo.} : 12\text{mo.} \end{array}\right\} :: \$100 : \$500 \text{ Ans.}$$

5.

$$\left.\begin{array}{l} \$500 : \$100 \\ \$6 : \$10 \end{array}\right\} :: 12\text{mo.} : 4\text{mo. Ans.}$$

6.

$$\left.\begin{array}{l} \$500 : \$100 \\ 4\text{mo.} : 12\text{mo.} \end{array}\right\} :: \$10 : \$6 \text{ Ans.}$$

7.

$$\left.\begin{array}{l} 8 \text{ men} : 24 \text{ men} \\ 13 \text{ weeks} : 52 \text{ weeks} \\ 6 \end{array}\right\} :: \$32 : \$384 \text{ Ans.}$$

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8.

60 men : 12 men
30 feet : 300 feet
6 feet : 8 feet
3 feet : 6 feet
8 hours : 12 hours
} :: 15 days : 120 days, Ans.

9.

16 horses : 32 horses
24 days : 48 days
} :: 84 bushels : 336 bushels, Ans.

10.

644lb. : 865lb.
150 miles : 64 miles
} :: $24.58 : $14.08.6 + Ans.

11.

7oz. 5dwt. = 145dwt.; 4s. 2d. = 50d.; 5s. 6d. = 66d.;
1s. 2d. = 14d.

66d. : 50d.
$4\frac{3}{4}$d. : 14d.
} :: 145dwt. : 1lb. 4oz. $3\frac{47}{627}$dwt. Ans.

SECTION XLVI.

CHAIN RULE.

(p. 183.)

2. FORM OF STATEMENT.

12lb. Boston, = 10lb. Amsterdam;
10lb. Amsterdam, = 12lb. Paris;
80lb. Paris.

OPERATION.

$$12 \times 10 \times 80 = 9600$$
$$10 \times 12 = 120$$
$$\frac{9600}{120} = 80\text{lb. Ans.}$$

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3. FORM OF STATEMENT.

25lb. Boston = 22lb. Nuremburg;
88lb. Nuremburg = 92lb. Hamburg;
46lb. Hamburg = 49lb. Lyons;
98lb. Lyons.

OPERATION.

$$\begin{array}{r} 25 \times 88 \times 46 \times 98 = 9917600 \\ 22 \times 92 \times 49 = 99176 \end{array} = 100\text{lb. Ans.}$$

4. FORM OF STATEMENT.

24s. Massachusetts = 32s. New York;
48s. New York = 45s. Pennsylvania;
15s. Pennsylvania = 10s. Canada;
100s. Massachusetts.

OPERATION.

$$\begin{array}{r} 32 \times 45 \times 10 \times 100 = 1440000 \\ 24 \times 48 \times 15 = 1728 \end{array} = 83\tfrac{1}{3}\text{s. Ans.}$$

5. FORM OF STATEMENT.

17 men = 25 women;
5 women = 7 boys;
75 boys.

OPERATION.

$$\begin{array}{r} 17 \times 5 \times 75 = 6375 \\ 25 \times 7 = 175 \end{array} = 36\tfrac{3}{7}\text{ men, Ans.}$$

6. FORM OF STATEMENT.

10bbls. cider = 5 cords wood;
20 cords wood = 4 tons hay;
50 tons hay.

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OPERATION.

$$\begin{array}{r} 10 \times 20 \times 50 = 10000 \\ 5 \times 4 = \quad 20 \end{array} = 500\text{bbls. Ans.}$$

7. FORM OF STATEMENT.

100A. Bradford = 120A. Haverhill;
50A. Haverhill = 65A. Methuen;
150A. Methuen.

OPERATION.

$$\begin{array}{r} 100 \times 50 \times 150 = 750000 \\ 120 \times 65 = \quad 7800 \end{array} = 96\tfrac{2}{13}\text{A. Ans.}$$

8. FORM OF STATEMENT.

10lb. cheese = 7lb. butter;
11lb. butter = 2bu. corn;
11bu. corn = 8bu. rye;
4bu. rye = 1 cord wood;
10 cords wood.

OPERATION.

$$\begin{array}{r} 10 \times 11 \times 11 \times 4 \times 10 = 48400 \\ 7 \times 2 \times 8 \times 1 = \quad 112 \end{array} = 432\tfrac{1}{7}\text{lb. Ans.}$$

SECTION XLVII.

COMPANY BUSINESS, OR FELLOWSHIP.

(p. 185.)

2. BY ANALYSIS.

The capital is $1100. A's stock is $250; his share of the loss will therefore be $\frac{250}{1100} = \frac{5}{22}$. B's stock is $300;

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his share of the loss therefore is $\frac{300}{1100} = \frac{3}{11}$. C's stock is $550, and his share of the loss therefore is $\frac{550}{1100} = \frac{1}{2}$. The loss, being 5 per cent. of the stock, is $1100 × .05 = $55.00. A's loss will therefore be $\frac{5}{2^2}$ of $55 = $12.50; B's loss $\frac{3}{11}$ of $55 = $15.00· and C's loss $\frac{1}{2}$ of $55 = $27.50 Ans.

FORM OF STATEMENT.

$1100 × .05 = $55.00 = loss.

$1100 : $55.00 :: $250 : $12.50 A's loss,
$1100 : $55.00 :: $300 : $15.00 B's loss,
$1100 : $55.00 :: $550 : $27.50 C's loss,
} Ans.

3. BY ANALYSIS.

The capital is $18780. C's stock being $6780, his share of the gain will be $\frac{6780}{18780} = \frac{113}{313}$ of $1000 = $361.02.2$\frac{114}{313}$. D's stock is $12000; his share of the gain will therefore be $\frac{12000}{18780} = \frac{200}{313}$ of $1000 = $638.97.7$\frac{198}{313}$ Ans.

FORM OF STATEMENT.

$18780 : $1000 :: $6780 : $361.02.2$\frac{114}{313}$ C's gain,
$18780 : $1000 :: $12000 : $638.97.7$\frac{198}{313}$ D's gain,
} Ans.

4. BY ANALYSIS.

M's stock is $3000, and his share of the gain will be $\frac{3000}{10000} = \frac{3}{10}$ of $500 = $150. P's stock is $2000; his share of the gain will therefore be $\frac{2000}{10000} = \frac{1}{5}$ of $500 = $100. Q's stock is $5000; his share of the gain, then, will be $\frac{5000}{10000} = \frac{1}{2}$ of $500 = $250 Ans.

FORM OF STATEMENT.

$10000 : $500 :: $3000 : $150 M's gain,
$10000 : $500 :: $2000 : $100 P's gain,
$10000 : $500 :: $5000 : $250 Q's gain,
} Ans.

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5. BY ANALYSIS.

The whole gain is $332.50; but C's gain is $120; A and B's gain, therefore, is $332.50 — $120 = $212.50. A's stock being $500, his share of the gain will be $\frac{500}{850} = \frac{10}{17}$ of $212.50 = $125. B's stock being $350, his share of the gain will be $\frac{350}{850} = \frac{7}{17}$ of $212.50 = $87.50. As the stock of each person in the firm bears the same proportion to his gain as the other; and as A's gain is $125, and his stock $500; therefore,

$125 A's gain : $500 A's stock :: $120 C's gain : $480 C's stock.

Then $480 ÷ 320 = $1.50, value of C's cloth per yard, Ans.

FORM OF STATEMENT.

$850 : $212.50 :: $500 : $125 A's gain,
$850 : $212.50 :: $350 : $87.50 B's gain, } Ans.
$125 : $500 :: $120 : $480 value of C's stock.
$480 ÷ 320 = $1.50 C's cloth per yard, Ans.

6. BY ANALYSIS.

$5000 + $6500 + $7500 = $19000 amount of stock.
$19000 × .40 = $7600 gross gain.
$7600 × .90 = $6840 net gain.
$\frac{5000}{19000} = \frac{5}{19}$ of $6840 = $1800 A's gain,
$\frac{6500}{19000} = \frac{13}{38}$ of $6840 = $2340 B's gain, } Ans.
$\frac{7500}{19000} = \frac{15}{38}$ of $6840 = $2700 C's gain,

FORM OF STATEMENT.

$19000 : $6840 :: $5000 : $1800 A's gain,
$19000 : $6840 :: $6500 : $2340 B's gain, } Ans.
$19000 : $6840 :: $7500 : $2700 C's gain,

7. BY ANALYSIS.

Amount of debts, $600 + $760 + $840 + $800 = $3000. For every dollar, then, each creditor will receive $\frac{2275}{3000} =$ $\$\frac{91}{120}$.

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A will receive $\frac{91}{120}$ of \$600 = \$455.00,
B will receive $\frac{95}{120}$ of \$760 = \$576.33$\frac{1}{3}$,
C will receive $\frac{84}{120}$ of \$840 = \$637.00,
D will receive $\frac{88}{120}$ of \$800 = \$606.66$\frac{2}{3}$,
} Ans.

FORM OF STATEMENT.

\$3000 : \$2275 :: \$600 : \$455.00 A receives,
\$3000 : \$2275 :: \$760 : \$576.33$\frac{1}{3}$ B receives,
\$3000 : \$2275 :: \$840 : \$637.00 C receives,
\$3000 : \$2275 :: \$800 : \$606.66$\frac{2}{3}$ D receives,
} Ans.

8. BY ANALYSIS.

As the bankrupt owes \$5000, and his effects are only \$4000, he will pay on each dollar $\frac{4000}{5000} = \frac{4}{5} =$ \$0.80 Ans.

FORM OF STATEMENT.

\$5000 : \$4000 :: \$1.00 : \$0.80 Ans.

9. BY ANALYSIS.

As \$1728 is $\frac{15}{100}$ of the sum owed, that sum must be $\frac{100}{15}$ of \$1728 = \$11520 Ans.

FORM OF STATEMENT.

\$0.15 : \$100 :: \$1728 : \$11520 Ans.

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SECTION XLVIII.

PARTNERSHIP ON TIME,

OR

DOUBLE FELLOWSHIP.

(p. 187.)

2. BY ANALYSIS.

$3200 for 12 months, is the same as $38400 for 1 month; and $4200 for 8 months, is the same as $33600 for 1 month. Therefore the whole stock may be considered $38400 + $33600 = $72000. A's share of the profit will therefore be $\frac{38400}{72000} = \frac{8}{15}$ of $240 = $128; B's share will be $\frac{33600}{72000} = \frac{7}{15}$ of $240 = $112 Ans.

FORM OF STATEMENT.

$3200 × 12 = $38400 A's product.
$4200 × 8 = $33600 B's product.

$72000

$72000 : $240 :: $38400 : $128 A's gain,
$72000 : $240 :: $33600 : $112 B's gain, } Ans.

BY ANALYSIS.

3. $300 for 5 months, is the same as $1500 for 1 month; $400 for 8 months, is the same as $3200 for 1 month; $500 for 3 months, is the same as $1500 for 1 month. The capital, then, may be considered $1500 + $3200 + $1500 = $6200. A's share of the gain will therefore be $\frac{1500}{6200} = \frac{15}{62}$ of $100 = 24.19\frac{11}{31}$; B's share, $\frac{3200}{6200} = \frac{16}{31}$ of $100 = 51.61\frac{9}{31}$; C's share, $\frac{1500}{6200} = \frac{15}{62}$ of $100 = 24.19\frac{11}{31}$ Ans.

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FORM OF STATEMENT.

$$\$300 \times 5 = \$1500$$
$$\$400 \times 8 = \$3200$$
$$\$500 \times 3 = \$1500$$
$$\$6200$$

$$\left.\begin{array}{l} \$6200 : \$100 :: \$1500 : \$24.19\frac{11}{31} \text{ A's gain,} \\ \$6200 : \$100 :: \$3200 : \$51.61\frac{9}{31} \text{ B's gain,} \\ \$6200 : \$100 :: \$1500 : \$24.19\frac{11}{31} \text{ C's gain,} \end{array}\right\} \text{Ans.}$$

4. 24 oxen for 8 weeks, is 1 ox for 192 weeks; 18 oxen for 12 weeks, is 216 oxen for 1 week; and 12 oxen for 10 weeks, is 1 ox for 120 weeks. The amount of pasturing is $192 + 216 + 120 = 528$ weeks. A's share is $\frac{192}{528} = \frac{4}{11}$ of $\$26.40 = \$9.60$; B's share is $\frac{216}{528} = \frac{9}{22}$ of $\$26.40 = \$10.80$; C's share is $\frac{120}{528} = \frac{5}{22}$ of $\$26.40 = \$6.00$ Ans.

FORM OF STATEMENT.

$$24 \text{ oxen} \times 8 = 192 \text{ oxen};$$
$$18 \text{ oxen} \times 12 = 216 \text{ oxen};$$
$$12 \text{ oxen} \times 10 = 120 \text{ oxen};$$
$$528 \text{ oxen.}$$

$$\left.\begin{array}{l} 528 : \$26.40 :: 192 : \$9.60 \text{ what A pays,} \\ 528 : \$26.40 :: 216 : \$10.80 \text{ what B pays,} \\ 528 : \$26.40 :: 120 : \$6.00 \text{ what C pays,} \end{array}\right\} \text{Ans.}$$

5. The "stock in trade" is a carriage to ride 144 miles; and the expense for the carriage, $25, may be considered the "loss," and the proportional part which each rode, the *time*. Now, by the Rule, each man is to bear his share of the loss (expense) in proportion as he has the use of the stock in trade (carriage). The two men had the use of the whole stock in trade for the first 20 miles, for which they pay $\frac{20}{144}$ of $\$25 = \$3.47.2\frac{2}{9}$; therefore, the share of each, for this distance, is $\frac{1}{2}$ of $\$3.47.2\frac{2}{9} = \$1.73.6\frac{1}{9}$. For the next 52

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miles the carriage was occupied by the two gentlemen and A. The expense of the carriage for this distance was $\$9.02.7\frac{7}{9}$, it being $\frac{52}{144}$ of $\$25$, of which each paid $\frac{1}{3} = \$3.00.9\frac{7}{27}$. For the next 42 miles, there were four passengers, viz. the two gentlemen, and A and B. The expense for this distance was $\frac{42}{144}$ of $\$25 = \$7.29.1\frac{2}{3}$, and each of the four passengers paid $\$1.82.2\frac{11}{12}$. For the remaining part of the distance, 30 miles, the expense was $\frac{30}{144}$ of $\$25 = \$5.20.8\frac{1}{3}$; and as C has been received into the carriage, each person bears $\frac{1}{5}$ of the expense for this distance, $\$1.04.1\frac{2}{3}$. Thus we perceive that each of the two gentlemen pays $\$1.73.6\frac{1}{3} + \$3.00.9\frac{7}{27} + \$1.82.2\frac{11}{12} + \$1.04.1\frac{2}{3} = \$7.60.9\frac{103}{108}$; A pays $\$3.00.9\frac{7}{27} + \$1.82.2\frac{11}{12} + \$1.04.1\frac{2}{3} = \$5.87.3\frac{91}{108}$; B pays $\$1.82.2\frac{11}{12} + \$1.04.1\frac{2}{3} = \$2.86.4\frac{7}{12}$; C pays $\$1.04.1\frac{2}{3}$ Ans.

FORM OF STATEMENT.

$\overline{\frac{20}{144}\times\frac{1}{2}} + \overline{\frac{52}{144}\times\frac{1}{3}} + \overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{526}{1728}$, first man's product.

$\overline{\frac{20}{144}\times\frac{1}{2}} + \overline{\frac{52}{144}\times\frac{1}{3}} + \overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{526}{1728}$, 2d man's product.

$\overline{\frac{52}{144}\times\frac{1}{3}} + \overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{406}{1728}$, A's prod.

$\overline{\frac{42}{144}\times\frac{1}{4}} + \overline{\frac{30}{144}\times\frac{1}{5}} = \frac{198}{1728}$, B's prod.

$\overline{\frac{30}{144}\times\frac{1}{5}} = \frac{72}{1728}$, C's prod.

$\frac{1728}{1728}$, sum of the products.

$\frac{1728}{1728} : \$25 :: \frac{526}{1728} : \$7.60.9\frac{103}{108}$, first man's expense,
$\frac{1728}{1728} : \$25 :: \frac{526}{1728} : \$7.60.9\frac{103}{108}$, 2d man's expense,
$\frac{1728}{1728} : \$25 :: \frac{406}{1728} : \$5.87.3\frac{91}{108}$, A's expense,
$\frac{1728}{1728} : \$25 :: \frac{198}{1728} : \$2.86.4\frac{7}{12}$, B's expense,
$\frac{1728}{1728} : \$25 :: \frac{72}{1728} : \$1.04.1\frac{2}{3}$, C's expense,
} Ans.

6. $\$4000$ for 4 months, is $\$100$ for 160 months. $\$4000 + \$500 = \$4500$ for 12 months, is $\$100$ for 540 months; and $\$4500 - \$1000 = \$3500$ for 4 months, is *$100 for* 140 months. A may therefore be considered as

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having $100 in trade 160 + 540 + 140 = 840 months. Again, $3000 for 10 months, is $100 for 300 months. $3000 — $1500 = $1500 for 4 months, is $100 for 60 months. $1500 + $3000 = $4500 for 6 months, is $100 for 270 months. B may therefore be considered as having $100 in trade for 300 + 60 + 270 = 630 months. Again, $2000 for 6 months, is $100 for 120 months. $2000 + $2000 = $4000 for 8 months, is $100 for 320 months. $4000 + $2000 = $6000 for 2 months, is $100 for 120 months. $6000 — $1500 = $4500 for 4 months, is $100 for 180 months. C may therefore be considered as having $100 in trade 120+320 + 120 + 180 = 740 months. The sum of A, B, and C's time is 840+630+740=2210 months. A's share of the gain will therefore be $\frac{840}{2210}$ of $4420 = $1680; B's share, $\frac{630}{2210}$ of $4420 = $1260; C's share $\frac{740}{2210}$ of $4420 = $1480 Ans.

FORM OF STATEMENT.

$4000 × 4 = 16000
500

4500 × 12 = 54000
1000

3500 × 4 = 14000

A's product = 84000

$3000 × 10 = 30000
1500

1500 × 4 = 6000
3000

4500 × 6 = 27000

B's product = 63000

$2000 × 6 = 12000
2000

4000 × 8 = 32000
2000

6000 × 2 = 12000
1500

4500 × 4 = 18000

C's product = 74000

A's product, 84000
B's product, 63000
C's product, 74000

221000

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$221000 : $4420 :: $84000 : $1680 A's gain,
$221000 : $4420 :: $63000 : $1260 B's gain,
$221000 : $4420 :: $74000 : $1480 C's gain, } Ans.

7. $4000 for 6 months, is $100 for 240 months. $4000 — $2000 = $2000 for 18 months, is $100 for 360 months. Jones may therefore be considered as having $100 in trade for 240 + 360 = 600 months. $3500 for 8 months, is $100 for 280 months. $3500 — 1500 = $2000 for 16 months, is $100 for 320 months. Eaton, then, may be considered as having $100 in trade 280 + 320 = 600 months. $2500 for 10 months, is $100 for 250 months. $2500 + $2000 = $4500 for 14 months, is $100 for 630 months. Brown, then, may be considered as having $100 in trade 250 + 630 = 880 months. As each man is supposed to have the same capital, his share of the gain will be in proportion to the *time* his $100 has been in trade.

The sum of all their times is 600 + 600 + 880 = 2080 months.

Jones's gain will be $\frac{600}{2080}$ of $1041.80 = 300.51\frac{2}{13}$
Eaton's gain will be $\frac{600}{2080}$ of $1041.80 = 300.51\frac{2}{13}$ } Ans.
Brown's gain will be $\frac{880}{2080}$ of $1041.80 = 440.76\frac{2}{13}$

FORM OF STATEMENT.

$4000 × 6 = 24000
2000
2000 × 18 = 36000
Jones's product = 60000

$3500 × 8 = 28000
1500
2000 × 16 = 32000
Eaton's product = 60000

$2500 × 10 = 25000
2000
4500 × 14 = 63000
Brown's product = 88000

60000
60000
88000
Sum of the products = 208000

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208000 : $1041.80 : : 60000 : 300.51\frac{12}{13}$ Jones's gain,
208000 : $1041.80 : : 60000 : 300.51\frac{12}{13}$ Eaton's gain,
208000 : $1041.80 : : 88000 : 440.76\frac{2}{13}$ Brown's gain, } Ans.

SECTION L.

LOSS AND GAIN.

2. (p. 190.) $7.00 : $6.12.5 : : $100 : $87.50; $100 — $87.50 = $12.50 per cent. Ans.

3. $1.00 — .12.5 = .87.5; $7.00 × .87.5 = 6.12\frac{1}{2}$ Ans.

4. $3.60 × 1.12\frac{1}{2}$ = $4.05 Ans.

5. $4.05 is $\frac{100}{112\frac{1}{2}}$ of the original cost; therefore, $\frac{100}{112\frac{1}{2}}$ of 4.05 = $3.60 Ans.

6. $8.50 × 1.10 = $9.35 Ans.

7. $9.35 ÷ 1.10 = $8.50 Ans.

8. $1.00 — .15 = .85; $1.25 ÷ .85 = 1.47\frac{1}{17}$; 1.47\frac{1}{17}$ × 1.12 = $1.64.7$\frac{1}{17}$ Ans.

9. $1.00 — .15 = .85; $1.25 ÷ .85 = 1.47\frac{1}{17}$, value of the wine; $1.64.7$\frac{1}{17}$ — 1.47\frac{1}{17}$ = $0.17.6$\frac{8}{17}$; 1.47\frac{1}{17}$: $0.17.6$\frac{8}{17}$: : $100 : $12 per cent. Ans.

10. As 12 per cent. was gained on the wine, $\frac{12}{100}$ of $1.64.7$\frac{1}{17}$ = 1.47\frac{1}{17}$ = cost; and $\frac{85}{100}$ × 1.47\frac{1}{17}$ = $1.25 = price for which it is sold. Ans.

11. $1.64.7$\frac{1}{17}$ ÷ 1.12 = 1.47\frac{1}{17}$ — $1.25 = 0.22\frac{1}{17}$; 1.47\frac{1}{17}$: 0.22\frac{1}{17}$: : $100 : $15 per cent. Ans.

12. $0.90 : $1.20 : : $100 : 133\frac{1}{3}$ — $100 = 33\frac{1}{3}$ per cent.; 1.12\frac{1}{2}$: $1.50 : : $100 : 133\frac{1}{3}$ — $100 = 33\frac{1}{3}$ per cent. Both have gained 33\frac{1}{3}$ per cent. Ans.

13. The present worth of 13 cents, due 8 months hence, is .13 ÷ 1.04 = .12$\frac{1}{2}$ cents. If, therefore, the cotton cost

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$12\frac{1}{2}$ cents, and is sold for 12 cents, on each yard there is lost $.125 - .12 = .005 = \frac{5}{125} = .04 = 4$ per cent. Ans.

14. $\$2.50 \times 24 = \$60.00$, price sold at. As the cloth was sold at $7\frac{1}{2}$ per cent. loss, it is evident $\$60.00$ is $\frac{92\frac{1}{2}}{100}$ of the cost; therefore, $\frac{100}{92\frac{1}{2}}$ of $\$60.00 = \$64.86.4\frac{32}{37}$ is the cost, Ans.

15. It is evident, if $7\frac{1}{2}$ per cent. be taken from any sum, $92\frac{1}{2}$ per cent. will remain; therefore, $.92\frac{1}{2} \times \$64.86.4\frac{32}{37} = \$60$, price sold at; $\$60.00 \div 24 = 2.50$ per yard, Ans.

16. By the last question, we perceive, that, if $7\frac{1}{2}$ per cent. be lost on $\$64.86.4\frac{32}{37}$, $\$60$ will be left; and if this be divided by $\$2.50$, we shall have the number of yards; thus, $\$60 \div \$2.50 = 24$ yards, Ans.

17. $\$64.86.4\frac{32}{37}$ was given for the cloth, and $\$2.50 \times 24 = \$60.00$ was received for it; therefore the loss was $\$64.86.4\frac{32}{37} - \$60.00 = \$4.86.4\frac{32}{37}$, or $\frac{4864\frac{32}{37}}{60000}$ of its value, $= .075 = 7\frac{1}{2}$ per cent. Ans.

18. If 17 per cent. be added to any sum, it is evident the original sum must be $\frac{100}{117}$ of the amount; therefore, $\frac{100}{117}$ of $\$12.50 = \$10.68.3\frac{89}{117} =$ the first cost, Ans.

19. If, on any sum, 25 per cent. has been lost, the original sum must have been $\frac{100}{75}$ of it. Therefore, $\frac{100}{75}$ of $\$75 = \$100$ was the price of the horse. But his real value was $\$100 \times 1.30 = \$130$; therefore he was sold for $\$130 - \$75 = \$55$ less than his value, Ans.

20. As the horse was worth 30 per cent. more than was given for him, and as he was sold for 25 per cent. less than he cost, these relative prices may be expressed thus; $\frac{130}{100}$, $\frac{75}{100}$; and their difference thus; $\frac{130}{100} - \frac{75}{100} = \frac{55}{100}$. Therefore, $\frac{55}{100} : \frac{75}{100} :: \$55 : \$75$ Ans.

21. $\$0.42 \times .95 = \$0.39.9$ Ans.

22. $63\text{gal.} - 15\text{gal.} = 48\text{gal. remaining}$; $\$112 \div 48 = \$2.33\frac{1}{3} \times .95 = \$2.21.6\frac{2}{3}$ Ans.

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23. $112 × .95 = $106.40 received for the wine; $106.40 ÷ $2.21.6⅔ = 48gal. remaining; 63gal.—48gal.= 15gal. leaked out, Ans.

24. 63gal. — 15gal. = 48gal. left; $2.21.6⅔ × 48 = $106.40; $106.40 ÷ .95 = $112 Ans.

25. 63gal. — 15gal. = 48gal.; $2.21.6⅔ × 48 = $106.40 price sold at; $112 — $106.40 = $5.60, loss;

$112 : $5.60 :: $100 : $5, loss per cent. Ans.

26. $5.60 ÷ .93 = 6.02\frac{14}{93}$ value per yard; $6.25 — 6.02\frac{14}{93}$ = 0.22\frac{79}{93}$ gain on each yard; and $\frac{22\frac{79}{93}}{602\frac{14}{93}} = \frac{17}{448} =$ .03$\frac{89}{893}$ = 3\frac{89}{112}$ gain per cent. Ans.

Or, 6.02\frac{14}{93}$: 0.22\frac{79}{93}$ :: $100 : 3\frac{89}{112}$ gain per cent. Ans.

27. $35 ÷ 1.04 = $33.65.3$\frac{11}{13}$ present worth of $35; $33.65.3$\frac{11}{13}$ — $30 = $3.65.3$\frac{11}{13}$ gain, Ans.

28. $1.25 ÷ .75 = $1.66⅔ value of the tea; $1.66⅔ — $1.40 = $0.26⅔ loss per pound. Therefore, $\frac{26\frac{2}{3}}{166\frac{2}{3}} = \frac{8}{50} =$ .16 = $16 per cent. loss, Ans.

Or, $1.66⅔ : $0.26⅔ :: $100 : $16 per cent. loss, Ans.

29. $1.35 × .88 = $1.18.8 price for ⅓ in ready money; $1.18.8 : $1.00 :: $5.00 : 4.20\frac{80}{297}$ cash price of 1 yard; $1.18.8 × 50 = $59.40 value of the indigo; $59.40 ÷ 3 = $19.80; $59.40 — $19.80 = $39.60; $39.60 ÷ $5.00 = 7$\frac{23}{25}$ yards delivered by B. Ans.

SECTION LI.

DUODECIMALS.

9. (p. 193.) 20ft. + 14ft. 6′ = 34ft. 6′ × 2 = 69ft. × 10ft. 4′ = 713ft.; 3ft. 2′ × 6ft. × 2 = 38ft.; 4ft. 4′ × 4ft. =

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17ft. 4′ + 38ft. = 55ft. 4′; 713ft. — 55ft. 4′ = 657ft. 8′ ÷ 9 = $73\frac{8}{27}$ yards, Ans.

10. 53ft. 6′ × 10ft. 3′ × 2ft. = 1096ft. 9′ Ans.

11. 6ft. 8′ + 5ft. 9′ + 4ft. 6′ + 3ft. 10′ = 20ft. 9′ × 3ft. 5′ × 4 = 283ft. 7′ Ans.

12. 3ft. 4′ + 2ft. 10′ = 6ft. 2′ × 2 = 12ft. 4′ × 7ft. 9′ = 95ft. 7′; 3ft. 4′ × 2ft. 10′ × 2 = 18ft. 10′ 8″ + 95ft. 7′ = 114ft. 5′ 8″ × 15 = 1717ft. 1′ square feet; 3ft. 4′ × 2ft. 10′ × 7ft. 9′ × 15 = 1097ft. 11′ ÷ 27 = $40\frac{2}{3}\frac{1}{2}\frac{5}{4}$ cubic yards, Ans.

13. 20ft. + 16ft. 6′ = 36ft. 6′ × 2 = 73ft. × 9ft. 6′ = 693ft. 6′; 20ft. × 16ft. 6′ = 330ft.; 330ft. + 693ft. 6′ = 1023ft. 6′ × 3 = 3070ft. 6′ ÷ 9 = 341yd. 1ft. 6′; 341yd. 1ft. 6′ — 90yd. = 251yd. 1ft. 6′ Ans.

14. 17ft. 6′ × 1ft. 7′ = 27ft. 8′ 6″ Ans.

15. 27ft. 9′ × 2ft. 5′ = 67ft. 0′ 9″ Ans.

16. 47ft. × 17ft. 9′ = 834ft. 3′ Ans.

17. 18ft. 9′ × 1ft. 6′ × 3 = 84ft. 4′ 6″ Ans.

18. 20ft. × 1ft. 6′ × $2\frac{1}{2}$ = 75ft. Ans.

19. 40ft. 6′ × 2ft. 6′ × $2\frac{3}{4}$ = 278ft. 5′ 3″ Ans.

20. 18ft. × 6ft. × 4ft. = 432ft. ÷ 128 = $3\frac{3}{8}$ cords, Ans.

21. 10ft. × 5ft. × 7ft. = 350ft. ÷ 128 = 2 cords 94 cubic feet, Ans.

22. 35ft. × 4ft. × 4ft. = 560ft. ÷ 128 = $4\frac{3}{8}$ cords, Ans.

23. 8ft. × 8ft. × 8ft. = 512ft. ÷ 128 = 4 cords, Ans.

24. 10ft. × 10ft. × 10ft. = 1000ft. ÷ 128 = $7\frac{1}{1}\frac{3}{6}$ cords, Ans.

25. 70ft. 6′ × 5ft. 3′ = 370ft. 1′ 4″ ÷ 4 = $92\frac{5}{8}\frac{1}{6}$ cord feet; $92\frac{5}{8}\frac{1}{6}$ ÷ 8 = $11\frac{1}{2}\frac{4}{5}\frac{5}{6}$ cords, Ans.

26. 97ft. 9′ × 3ft. 6′ = 342ft. 1′ 6″ ÷ 4 = $85\frac{5}{2}\frac{1}{5}\frac{1}{6}$ cord feet ÷ 8 = $10\frac{1}{2}\frac{7}{5}\frac{7}{6}$ cords, Ans.

27. 100ft. × 6ft. 11′ = 691ft. 8′ ÷ 4 = $172\frac{1}{1}\frac{1}{2}$ cord feet ÷ 8 = $21\frac{5}{8}\frac{2}{6}$ cords, Ans.

28. 8ft. × 4ft. × 10 = 320ft. × 2′ = $53\frac{1}{3}$ft. × 5 = $266\frac{2}{3}$ ÷ 128 = $2.08\frac{1}{3}$ Ans.

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29. 3ft. 8′ × 5ft. = 18ft. 4′ ÷ 2 = $9\frac{1}{6}$ feet, Ans.

30. 3ft. 10′ × 6ft. 6′ = 24ft. 11′ ÷ 2 = $12\frac{11}{24}$ feet, Ans.

31. 128ft. ÷ 8 = 16ft. ÷ 3ft. 11′ = 4ft. 6′ $10\frac{2}{7}$″ Ans.

32. 128ft. × 2 = 256ft. ÷ 12 = 21ft. 4′ ÷ 3ft. 9′ = 5ft. 8′ $3\frac{1}{5}$″ Ans.

34.

£.	s.	d.	qr.
1	19	11	3
1	19	11	3
1	19	11	3
1	17	11	$3\frac{1}{20}$
	1	9	$3\frac{2}{240}$
		1	$1\frac{8}{960}$

Ans. 3£. 19s. 11d. $0\frac{1}{960}$qr.

NOTE.—The first product is obtained by multiplying the multiplicand by 1, the second product by multiplying it by $\frac{1}{20}$, the third product by multiplying by $\frac{1}{240}$, and the fourth product by multiplying by $\frac{3}{960}$.

35.

m.	fur.	rd.			
3	4	12			
2	6	8			
6	8	24			
2	5	9			
		28	4	11	$1\frac{1}{5}$

Ans. 9m. 6fur. 21rd. 4ft. 11in. $1\frac{1}{5}$br.

NOTE.—The multiplicand is first multiplied by 2, then by $\frac{8}{8}$, and lastly by $\frac{8}{320}$.

36. 71° 4′
4′

Ans. 4h. 44′ 16″

38. 14£. 5s. + 13£. 10s. + 11£. 5s. = 39£. 0s.; and 46£. 5s. — 39£. 0s. = 7£. 5s.
18s. × 3 = 2£. 14s.; 7£. 5s. — 2£. 14s. = 4£. 11s. gain.
4£. 11s. ÷ 39 = 2s. 4d. gain on each £.

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£.	s.	d.
14	5	0
	2	4
1	8	6
	4	9

Ans. A's gain = 1£. 13s. 3d.

£.	s.	d.
13	10	0
	2	4
1	7	0
	4	6

Ans. B's gain = 1£. 11s. 6d.

£.	s.	d.
11	5	0
	2	4
1	2	6
	3	9

Ans. C's gain = 1£. 6s. 3d.

SECTION LIII.

SQUARE ROOT.

32. (p. 202.) $\sqrt{141376} = 376$ Ans.

33. $1760 \times 9 = 15840$; $\sqrt{15840} = 125.857 +$ feet, Ans.

34. $24 \times 24 = 576 \div 2 = 288$; $\sqrt{288} = 16.97 +$ in. Ans.

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35. $2 : 3 :: 2400 : 3600$; $\sqrt{3600} = 60$ trees in length. $3 : 2 :: 2400 : 1600$; $\sqrt{1600} = 40$ trees in breadth. $60 - 1 = 59 \times 7 = 413$; $40 - 1 = 39 \times 7 = 273$; $413 \times 273 = 112749$ square yards, Ans.

36. $2 : 3 :: \frac{3}{4} \times \frac{3}{4} = \frac{9}{16} : \frac{27}{32} = .84375$; $\sqrt{.84375} = .918+$ in. Ans.

37. $2 \times 2 = 4 : 1.5 \times 1.5 = 2.25 :: 50$m. $: 28.125$m. $=$ 28m. $7\frac{1}{2}$sec. Ans.

38. $4 \times 4 \times 3 = 48 : 6 \times 6 \times 2 = 72 ::$ 4h. : 6h. Ans.

39. $144 \times 144 = 20736$; $64 \times 64 = 4096$; $20736 - 4096 = 16640$; $\sqrt{16640} = 128.99+$ feet, Ans.

40. $20 \times 20 = 400$; $16 \times 16 = 256$; $12 \times 12 = 144$; $400 + 256 + 144 = 800$; $\sqrt{800} = 28.28+$ feet, Ans.

41. $128 \times 128 = 16384$; $72 \times 72 = 5184 + 16384 = 21568$; $\sqrt{21568} = 146.86+$ miles, Ans.

42. $100 \times 100 = 10000$; $70 - 5 = 65$; $65 \times 65 = 4225$; $10000 - 4225 = 5775$; $\sqrt{5775} = 75.993420+$; $80 \times 80 = 6400$; $50 - 5 = 45$; $45 \times 45 = 2025$; $6400 - 2025 = 4375$; $\sqrt{4375} = 66.143782+$; $75.993420 + 66.143782 = 142.137202 \times 142.137202 = 20202.984192388804$; $70 - 50 = 20$; $20 \times 20 = 400$; $20202.984192388804 + 400 = 20602.984192388804$; $\sqrt{20602.984192388804} = 143.537396 +$ feet, Ans.

43. $400 \times 400 = 160000$; $160 \times 160 = 25600$; $160000 - 25600 = 134400$; $\sqrt{134400} = 366.6 - 50 = 316.6$ Ans.

44. $70 \times 70 = 4900$; $40 \times 40 = 1600$; $30 \times 30 = 900$; $4900 - 1600 = 3300$; $\sqrt{3300} = 57.445+$; $4900 - 900 = 4000$; $\sqrt{4000} = 63.245 + 57.445 = 120.69+$ feet, Ans.

45. $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100}$: 1in. :: 450lb. : 45000lb. Ans.

46. $80 \times 80 = 6400$; $40 \times 40 = 1600$; $80 \times 2 = 160$; $6400 - 1600 = 4800$; $4800 \div 160 = 30$ height of the stump, Ans.

47. Circles being to each other as the squares of their diameters, they are also to each other as the squares of

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their semidiameters. The grindstone being 48 inches in diameter, its semidiameter will be 24 inches. $24 \times 24 = 576 \div 4 = 144$; $576 - 144 = 432$, $\sqrt{432} = 20.78$ = to the semidiameter that will be *left* after A has ground off his share; therefore his share will be $24 - 20.78 = 3.22$in.; $432 - 144 = 288$; $\sqrt{288} = 16.97$; $20.78 - 16.97 = 3.81$in., B's share; $288 - 144 = 144$; $\sqrt{144} = 12$in.; $16.97 - 12 = 4.97$in., C's share; $\sqrt{144} = 12$in., D's share, Ans.

48. $160 - .785398 = 203.71836$; $\sqrt{203.71836} = 14.273 +$; $14.273 \div 2 = 7.136 +$ rods, Ans.

SECTION LIV.

CUBE ROOT.

17. (p. 207.) $3 \times 3 \times 3 = 27 : 6 \times 6 \times 6 = 216 ::$ 4lb. : 32lb. Ans.

18. $1 \times 1 \times 1 = 1 : 3.5 \times 3.5 \times 3.5 = 42.875 ::$ \$120 : \$5145 Ans.

19. 5ft. 10in. = 70in.; 10ft. $4\frac{3}{5}$in. = 124.6in.; $70 \times 70 \times 70 = 343000$; $124.6 \times 124.6 \times 124.6 = 1934434.936$; 343000 : 1934434.936 :: 180lb. : 1015.1 + lb. Ans.

20. 2lb. : 2000lb. :: $4 \times 4 \times 4 = 64$in. : 64000;
$\sqrt[3]{64000} = 40$in. = 3ft. 4in. high;
2lb. : 2000lb. :: $3 \times 3 \times 3 = 27$in. : 27000in.;
$\sqrt[3]{27000} = 30$in. = 2ft. 6in. wide;
2lb. : 2000lb. :: $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} = \frac{1}{64} : \frac{1000}{64}$;
$\sqrt[3]{\frac{1000}{64}} = \frac{10}{4} = 2\frac{1}{2}$in. thick, Ans.

21. $5 \times 5 \times 5 = 125$ft. : $20 \times 20 \times 20 = 8000$ft. :: 1cwt. : 64cwt. Ans.

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22. $6\times6\times6=216$ft. : $10\times10\times10=1000$ft. : : 1 day : 4.629 + days, Ans.

23. $6\times6\times6=216$ft. : $8\times8\times8=512$ft. : : 600lb. : 1422.2 + lb. Ans.

SECTION LV.

ARITHMETICAL PROGRESSION.

2. (p. 210.) $\frac{45-5}{11-1}=4$ miles, Ans.

3. $\frac{48-3}{10-1}=5$ years, Ans.

4. $\frac{39-3}{19-1}=2$ years, Ans.

6. $\frac{\overline{51+7}\times12}{2}=348$ miles, Ans.

7. $\frac{\overline{39+3}\times19}{2}=399$ years, Ans.

8. $320\times30=9600=$ rods in 30 miles; but there will be one more stone in this distance than there are rods, because there will be a stone at each end of the 30 miles. The man must travel 2 rods to bring the first stone to the basket, and 60 miles and 2 rods to bring the last stone; wherefore the following formula:

$\frac{\overline{19202+2}\times9601}{2}=92188802$rd. $=288090$ miles 2 rods, Ans.

10. $\frac{39-3}{2}+1=19$ scholars, Ans.

11. $\frac{51-7}{4}+1=12$ days, Ans.

12. $\frac{\overline{45+3}\times\overline{45-3+2}}{2\times2}=528$ sum of the series, Ans.

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13. $\frac{\overline{618+6}\times\overline{618-6}+12}{2\times 12}=\$162.24$ Ans.

14. $\frac{45+3\times 45-3}{528\times 2-48}=2$ common difference, Ans.

15. $\frac{528\times 2}{22}-3=\$45$; $\frac{45-3}{22-1}=\$2$ difference, Ans.

SECTION LVI.

GEOMETRICAL SERIES.

3. (p. 214.) $\frac{72}{3^{6-1}}=\frac{8}{27}$ first term, Ans.

4. $2\times 2^{30-1}=\$10737418.24$ Ans.

5. $5\times 3^{7-1}=3645$ seventh term, Ans.

6. $50\times 1.06^{5-1}=63.123848$ last term, Ans.

7. $\$160\times 1.06^{7-1}=\$226.96.3.05796096$ Ans.

8. $\$300\times 1.05^{8-1}=\$543.23.6+$ Ans.

9. $\$100\times 1.06^{31-1}=\$574.34.911729132501162641-0633231080264584635725219606935738777 6$ Ans.

11. $\frac{10^{12}-1}{10-1}\times 1=\$111111111111$ Ans.

12. $\frac{2^{40}-1}{2-1}\times 10=\$109951162777.50$ Ans.

13. $\frac{1.06^{4}-1}{1.06-1}=218.7308$ sum of the series, Ans.

14. By examining this question, we find there have been 21 deposites. The amount of the last deposite is $10.60, the 10 dollars being on interest only one year. The last but one is $11.23.6. The last but two is $11.91.0.16. The last but three is $12.62.4.7696, and so on. Thus we have a

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regular geometrical series, the ratio of which is 1.06, the first term $10.60, the number of terms 21, to find the sum of all the series.

$$\frac{1.06^{21}-1}{1.06-1}\times 1060 = \$423.92.2+ \text{ Ans.}$$

15. $\dfrac{7-7\times\frac{1}{4}^{5}}{1-\frac{1}{4}} = \dfrac{7-\frac{7}{1024}}{\frac{3}{4}} = 9\frac{83}{256}$ sum of the series, Ans.

16. $2\times 2^{153-1} = \$1141798154164767904846628775559596109106197 2.99.2$ Ans.

NOTE.—This question should be performed by the rule under Problem I.

SECTION LVII.

INFINITE SERIES.

2. (p. 215.) $\frac{5\times 5}{4} = 6\frac{1}{4}$ Ans.

3. $\frac{8\times 7}{7-1} = 9\frac{1}{3}$ Ans.

4. $\frac{1\times 3}{3-1} = 1\frac{1}{2}$ Ans.

5. $\frac{11\times 7}{7-1} = 12\frac{5}{6}$ Ans.

6. $\frac{1\times 2}{2-1} = 1\frac{1}{3}$ Ans.

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SECTION LVIII.

DISCOUNT BY COMPOUND INTEREST.

2. (p. 216.) $1.06^4 = 1.26247696$) $500.00 ($396.04.6+ Ans.

3. $1.05^{10} = 1.628894$) $1000.00.0 ($613.91.3 + Ans.

4. $1.06^2 = 1.1236$) $800.00.0 ($711.99.7 +

$800.00.0 — $711.99.7 + = $88.00.3 Ans.

SECTION LIX.

ANNUITIES AT COMPOUND INTEREST.

2. (p. 217.) $\frac{1.06^5 - 1}{1.06 - 1} \times \$500 = \$2818.54.6+$ Ans.

3. $\frac{1.06^{10} - 1}{1.06 - 1} \times \$1000 = \$13180.79.4+$ Ans.

4. $\frac{1.06^3 - 1}{1.06 - 1} \times \$30 = \$95.50.8+$ Ans.

7. $\frac{1.06^{10} - 1}{1.06 - 1} \times \$500 = \$6590.39.75$ amount of an annuity of $500 for 10 years; therefore

$1.06^{10} = 1.7908476$) $6590.39.75 ($3680.04 + Ans.

8. $\frac{1.05^7 - 1}{1.05 - 1} \times \$200 = \$1628.40.169+$ amount of an annuity of $200 for 7 years at 5 per cent. To find the present worth of this sum, we divide it by the amount of $1

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for the given rate and time. Thus the amount of $1 is $1.05^7 = \$1.4071+$; therefore

$$\$1.4071 \,)\, \$1628.40.169 \,(\, \$1157.27+ \text{ Ans.}$$

Or, $\$1.4071 : \$1.00 :: \$1628.40.169 : \$1157.27+$ Ans.

9. $\dfrac{1.06^8 - 1}{1.06 - 1} \times 300 = \$2969.23.9+$ amount of $300 for 8 years. $1.06^8 = \$1.593848+$ amount of $1 for 8 years. $\$1.593848 : \$1.00 :: \$2969.23.9 : \$1862.93.8$ Ans.

10. $\dfrac{1.06^9 - 1}{1.06 - 1} \times \$100 = \$1149.13.16+$ amount of $100 for 9 years. $1.06^9 = \$1.689478959$ amount of $1 for 9 years. $\$1.689478959 : \$1.00 :: \$1149.13.16+ : \$680.16.9+$ Ans.

13. By Table I. the amount of $1 for 25 years, is $47.727099; therefore $800 will amount to $800 × $47.727099 = $38181.67.9 + Ans.

14. By Table I. the amount of $1 for 30 years is $79.058186; therefore the amount of $40.00 is $40 × $79.058186 = $3162.32.7 + Ans.

15. By Table II. the present worth of an annuity of $1 for 40 years is $15.046297; therefore the present worth of $500 is $500 × $15.046297 = $7523.14.8 + Ans.

16. By Table I. the amount of $1 for 6 years is $6.975319; the amount, therefore, of $700, is $700 × $6.975319 = $4882.72.3 + Ans.

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SECTION LX.

ALLIGATION.

(p. 221.)

2.

19bu. at $1.00 = $19.00
40bu. at .66 = 26.40
11bu. at .50 = 5.50

70bu. : $50.90 :: 1bu. : $0.72.7$\frac{1}{7}$ Ans.

3.

3lb. at 22 carats = 66 carats,
3lb. at 20 carats = 60 carats.

6lb. : 126 carats :: 1lb. : 21 carats, Ans.

4.

20lb. at $0.70 = $14.00
15lb. at .60 = 9.00
80lb. at .40 = 32.00

115lb. : $55.00 :: 1lb. : 0.47\frac{18}{23}$ Ans.

6.

$ cts.	lb.	lb.	
.50	20	20 at $0.50	
.75	20	20 at .75	Ans.
1.00	30 + 5	35 at 1.00	

Mean rate $0.80

7.

cts.	
.15	4oz. of 15 carats,
.19	3oz. of 19 carats,
.23	1oz. of 23 carats,
.24	5oz. of 24 carats,

Mean rate $0.20 — Ans.

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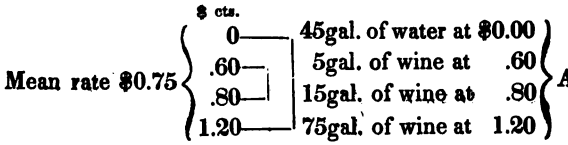
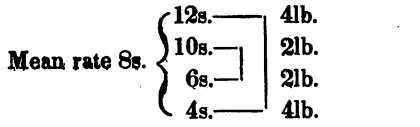
8.

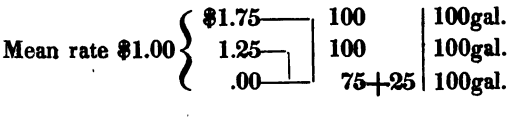


10.



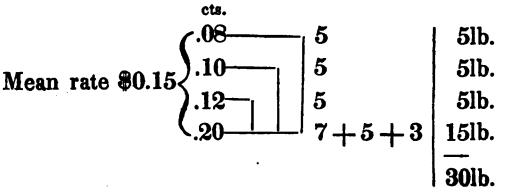
4lb. : 2lb. : : 20lb. : 10lb. at 6s.
4lb. : 2lb. : : 20lb. : 10lb. at 10s. } Ans
4lb. : 4lb. : : 20lb. : 20lb. at 12s.

11.



100gal. : 100gal. : : 20gal. : 20gal. port wine,
100gal. : 100gal. : : 20gal. : 20gal. temperance wine, } Ans.

13.



lb. lb. lb. lb.
30 : 200 : : 5 : $33\frac{1}{3}$ at .08cts.
30 : 200 : : 5 : $33\frac{1}{3}$ at .10cts. } Ans.
30 : 200 : : 5 : $33\frac{1}{3}$ at .12cts.
30 : 200 : : 15 : 100 at .20cts.

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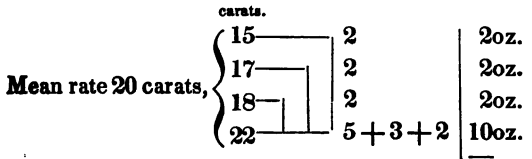
14.



oz. oz. oz. oz.
2 : 2 :: 5 : 5 of 15 carats,
2 : 2 :: 5 : 5 of 17 carats, } Ans.
2 : 10 :: 5 : 25 of 22 carats,

SECTION LXI.

PERMUTATIONS AND COMBINATIONS.

2. (p. 225.) $1\times2\times3\times4\times5\times6\times7\times8\times9\times10=$ 3628800 days, Ans.

3. $1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times12=$ 479001600 changes. 365da. 5h. 49m. = 525949 minutes. $479001600\div10=47900160$ minutes. $47900160\div525949$ = 91y. 38801m. = 91y. 26da. 22h. 41m. Ans.

4. $1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times12\times13\times14\times15\times16\times17\times18\times19\times20\times21\times22\times23\times24\times25\times26=$ 403291461126605635584000000 changes, Ans.

6. $20\times19\times18\times17\times16\times15\times14\times13\times12\times11=$ 670442572800; $1\times2\times3\times4\times5\times6\times7\times8\times9\times10=$ 3628800; $670442572800\div3628800=$ $1847.56 Ans.

In performing this 6th question, we adopt the following

RULE.

Take the series 1, 2, 3, *&c. up to the number to be taken at a time, and find the product of all the terms. Then take*

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a series of as many terms, decreasing by 1, *from the given number, out of which the election is to be made, and find their product. Then divide the last product by the former, and the quotient is the number sought.*

7. $26 \times 25 \times 24 \times 23 \times 22 \times 21 = 165765600$ words, Ans.

9. $6 \times 8 \times 9 \times 9 = 3888$ choices, Ans.

10. $6 \times 6 \times 6 \times 6 \times 6 = 7776$ changes, Ans.

SECTION LXII.

SINGLE POSITION.

2. (p. 227.) By Analysis. — If $\frac{1}{3}$ and $\frac{1}{4}$ of any number be taken, $\frac{5}{12}$ will remain; and if 60 be $\frac{5}{12}$ of a number, 12 will be $\frac{1}{12}$; and if 12 be $\frac{1}{12}$, 12 twelfths will be 144 Ans.

3. By Analysis. — If any number be increased $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of itself, the number will be $2\frac{1}{12}$, or $\frac{25}{12}$ of itself; and if $\frac{25}{12}$ of a number be 125, $\frac{1}{12}$ will be 5, and $\frac{12}{12}$ will be 60 Ans.

4. By Analysis. — B's age is $\frac{1}{2}$ of A's, and C's age is $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{6}$ of A's. These fractions, then, $\frac{1}{1}$, $\frac{1}{2}$, and $\frac{1}{6}$, will express the relative proportion of their ages. The sum of these numbers is $\frac{1}{1} + \frac{1}{2} + \frac{1}{6} = \frac{8}{3}$. If $\frac{8}{3}$ be 140, $\frac{3}{3}$ will be $84 =$ A's age; B's age will therefore be $\frac{1}{2} \times 84 = 42$; C's age will be $\frac{1}{3}$ of $42 = 12$ Ans.

5. By Analysis. — Any sum, at 6 per cent. simple interest, will, in 10 years, amount to $1\frac{3}{5}$ of itself; thus, $\$100 \times .06 = \$6$; $6 \times 10 = \$60$; $60 + 100 = \$160$; $\frac{160}{100} = 1\frac{3}{5} = \frac{8}{5}$; and if \$560 be $\frac{8}{5}$, \$70 will be $\frac{1}{5}$, and $\frac{5}{5}$ will be \$350 Ans.

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6. By Analysis. — Seven-eighths of any number is $\frac{27}{40}$ more than $\frac{1}{5}$ of it; thus, $\frac{7}{8} - \frac{1}{5} = \frac{27}{40}$; and if $\frac{27}{40}$ be 81, $\frac{1}{40}$ will be $\frac{81}{27}$, and $\frac{40}{40}$ will be $\frac{81}{27} \times \frac{40}{1} = \frac{3240}{27} = 120$ Ans.

7. By Analysis. — The difference between $\frac{3}{5}$ and $\frac{4}{7}$ is $\frac{1}{35}$; and if $\frac{1}{35}$ of a number be $2\frac{17}{35} = \frac{87}{35}$, the whole number, or $\frac{35}{35}$, will be $\frac{87}{35} \times \frac{35}{1} = 87$ Ans.

DOUBLE POSITION.

2. (p. 229.) By Analysis. — A having gained a sum equal to $\frac{1}{4}$ of his stock, his present stock will be $\frac{5}{4}$ of his original stock. B having lost $225, and his present stock being $\frac{1}{2}$ of A's, that is, $\frac{1}{2}$ of $\frac{5}{4} = \frac{5}{8}$ of what he had at first; it will therefore follow, that $225 is $\frac{8}{8} - \frac{5}{8} = \frac{3}{8}$ of B's original stock. And if $\frac{3}{8}$ be $225, $\frac{1}{8}$ is $75; and if $\frac{1}{8}$ be $75, $\frac{8}{8}$, or the whole stock, will be $8 \times \$75 = \$600.00$ Ans.

3. By Analysis. — It appears that his oldest son was 12 years older than the youngest, and that the oldest was also twice as old as the youngest; the oldest must therefore be 24 years old, and the youngest 12; the second son being 4 years younger than the first, and the third being 4 years older than the youngest, their ages will be 20 and 16 Ans.

4. By Analysis. — It appears by the question, that, if the saddle be put on the first horse, the horse and saddle will be twice the value of the second horse; that is, the first horse will be equal to twice the value of the second horse minus the saddle. Again, if the saddle be put on the second horse, the second horse and the saddle will be equal to three times the value of the first horse; that is, three times the value of the first horse is equal to the value of the second horse plus the saddle. We have before shown, that the value of the first horse is equal to twice the value of the second horse minus the saddle; therefore, by adding these quantities, we find that four times the value of the first

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horse is equal to three times the value of the second horse. Again, as the first horse and saddle were worth twice the second horse, it will follow, that the saddle is worth twice the second horse minus the first horse; that is, the saddle is worth twice the second horse minus three-fourths the second horse, because we have before shown, that the first horse is three-fourths the value of the second horse; therefore the saddle is worth five-fourths of the second horse; but the saddle is worth $50; and if five-fourths of the second horse is worth $50, one-fourth is worth $10, and four-fourths, that is, the whole value of the second horse, will be $40; and as we have before shown, that the first horse is worth three-fourths of the second horse, his value will therefore be $30 Ans.

5. By Analysis. — Reducing $\frac{2}{3}$ and $\frac{8}{33}$ to a common denominator, the fractions will be $\frac{22}{33}$ and $\frac{8}{33}$; therefore $\frac{22}{33}$ of the time past from noon will be equal to $\frac{8}{22}$ of the time to midnight. Divide 12 hours into two parts, in the proportion of 8 to 22, and the first part will be the time from noon; thus, $8 + 22 = 30 : 8 :: 12\text{h.} : 3\text{h. } 5\text{m.}$ Ans.

6. By Analysis. — If A saves $\frac{1}{12}$ of his income, he spends $\frac{11}{12}$ of it. If B, in 10 years, spends $600 more than his income, he must expend each year $60 more than his income. And as B spends $100 yearly more than A, it is evident A will save $40 per annum; and as A spends $\frac{11}{12}$, $40 must be $\frac{1}{12}$ of his income; therefore his whole income will be 12 times $40 = $480 Ans.

7. By the Rule of Position. — It appears by the tenor of the question, that 90 must be so divided into two parts, that, if the larger part be multiplied by 60, and the smaller part by 80, the difference of the products shall be 3300. We therefore suppose the larger part to be 60, and the smaller part 30, and proceed according to the Rule; thus, $60 \times 60 = 3600$; $30 \times 80 = 2400$. The difference between these products is $3600 - 2400 = 1200$, which is

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3300 — 1200 = 2100 *less* than it should be. Again, we divide 90 into the two parts, 80 and 10, and multiply them by 60 and 80 as before, and find the result as follows; $80 \times 60 = 4800$; $10 \times 80 = 800$; $4800 - 800 = 4000$, which is $4000 - 3300 = 700$ *more* than it should be. We then proceed by the Rule, thus; $60 \times 700 = 42000$; $80 \times 2100 = 168000$; $42000 + 168000 = 210000$ sum of the products; $2100 + 700 = 2800$ sum of the errors; $210000 \div 2800 = 75$ = larger number; and $90 - 75 = 15$ smaller number. Therefore we find he labored 75 days, and was idle 15 days, Ans.

9. As the head and tail of the fish weigh 36lb. and $\frac{1}{6}$ of the body; and as the body weighs as much as the head and tail, it is evident, that 30lb. is $\frac{5}{6}$ of half the weight of the fish, and 30lb. is $\frac{5}{6}$ of 36lb.; therefore the head and tail weigh 36lb. The body also must weigh 36lb., because, by the question, it weighs as much as the head and tail both; therefore the whole weight of the fish will be $36 + 36 = 72$lb. Ans.

10. The weights must be 1, 3, 9, 27, and 81lb., and these numbers may be obtained by multiplying; thus, $1 \times 1 = 1$, $1 \times 3 = 3$, $3 \times 3 = 9$, $9 \times 3 = 27$, $27 \times 3 = 81$ Ans.

SECTION LXV.

GEOMETRY.

1. (p. 257.) $15 \times 2 = 30$ feet, Ans.

2. $128 \times 48 = 6144$ miles, Ans.

3. $693 \times 693 = 480249$ feet; $480249 \div 272\frac{1}{4} = 1764$p.; $1764 \div 160 = 11$A. 0R. 4p. Ans.

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4. $40 \times 40 = 1600$ feet; $20 \times 20 \times 2 = 800$ feet; $1600 - 800 = 800$ feet, Ans.

5. $\sqrt{3600} = 60$ feet; $3600 \div 2 = 1800$ feet; $\sqrt{1800} = 42.427+$ feet; 60 feet $-$ 42.427 feet $= 17.573$ feet; $17.573 \div 2 = 8.78+$ feet, Ans.

6. $8 \times 12 = 96$ feet, Ans.

7. $12 \times 18 = 216$ feet; $216 \div 2 = 108$ feet, Ans.

8. $15.6 + 9.2 + 10.4 = 35.2$ feet; $35.2 \div 2 = 17.6$ feet; $17.6 - 15.6 = 2.00$; $17.6 - 9.2 = 8.4$; $17.6 - 10.4 = 7.2$; $17.6 \times 2 \times 8.4 \times 7.2 = 2128.896$; $\sqrt{2128.896} = 46.139+$ feet, Ans.

9. $144 \times 3.141592 = 452.389248$ feet, Ans.

10. $7964 \times 3.141592 = 25019.638688+$ miles, Ans.

11. $50 \times .886227 = 44.31135+$ rods, Ans.

12. $80 \times .707016 = 56.56128+$ feet, Ans.

13. $761 \times 761 \times .785398 = 454840.475158$ feet, Ans.

14. $320 \times 3 = 960 \times 960 \times .785398 = 7238.227968$ rods; $7238.227968 \div 160 = 4523.89+$ acres, Ans.

16. $360 \times .282094 = 101.55+$ rods, Ans.

17. $5000 \times .2756646 = 1378.323+$ feet, Ans.

18. $5000 \times .225079 = 1125.395$ rods, Ans.

19. $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2} = 3\frac{3}{8}$ feet, Ans.

20. $6 \times 2\frac{1}{2} \times 1\frac{3}{4} = 26\frac{1}{4}$ feet, Ans.

21. $3\frac{1}{6} \times 2\frac{2}{3} \times 2\frac{1}{2} = 21\frac{1}{9}$ feet, Ans.

22. $2\frac{1}{2} \times 3 = 7\frac{1}{2}$; $7\frac{1}{2} \div 2 = 3\frac{3}{4}$; $3\frac{3}{4} - 2\frac{1}{2} = 1\frac{1}{4} = \frac{5}{4}$; $3\frac{3}{4} = \frac{15}{4}$; $\frac{15}{4} \times \frac{5}{4} \times \frac{5}{4} \times \frac{5}{4} = \frac{18756}{256} = 7.32421093$ feet; $\sqrt{7.32421093} = 2.7063+$ feet; $2.7063 \times 12 = 32.47+$ feet, Ans.

23. $5+4+3=12$; $12 \div 2 = 6$ feet; $6-5=1$; $6-4=2$; $6-3=3$; $6 \times 1 \times 2 \times 3 = 36$; $\sqrt{36} = 6$; $6 \times 10 = 60$ feet, Ans.

24. $2\frac{1}{2} \times 2\frac{1}{2} \times .785398 \times 12\frac{1}{2} = 61.35921875$; $61.35921875 \div 3 = 20.45+$ feet, Ans.

25. $5+6+7=18$; $18 \div 2 = 9$; $9-5=4$; $9-6=3$; $9-7=2$; $9 \times 4 \times 3 \times 2 = 216$; $\sqrt{216} = 14.69693+$;

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$14.69693 \times 14\frac{1}{2} = 213.105485$; $213.105485 \div 3 = 71.035+$ feet, Ans.

26. $75 \div .785398 = 95.492987$; $95.492987 \div 2 = 47.746493+$ square rods, Ans.

27. $75 \div .785398 = 95.492987$; $\sqrt{95.492987} = 9.772+$ rods, Ans.

28. $25 \times 25 = 625$; $625 \div 2 = 312.5$; $625 - 312.5 = 312.5$; $25 \times 25 \times .785398 = 490.87375$; $625 - 490.87375 = 134.12625$; $490.87375 - 312.5 = 178.37375$ Ans.

29. $9 \times 20 = 180$; $180 \div 2 = 90$ feet, Ans.

30. $24 \times 12 = 288$; $12 \times 12 = 144$; $144 \div 3 = 48$; $288 + 48 = 336$; $336 \times .785398 \times 40 = 10555.74912$; $10555.74912 \div 144 = 73.303+$ feet, Ans.

31. $12 \times 12 \times 12 \times .5236 = 904.78$ inches, Ans.

32. $25000 \times .31831 = 7957.75$; $7957.75 \times 7957.75 = 63325785.0625$; $63325785.0625 \times 7957.75 = 503930766081.109375$; $503930766081.109375 \times .5236 = 263858149120.06886875$ cubic miles, Ans.

33. $24 \times 3.141592 = 75.398208$; $75.398208 \times 24 = 1809.556992$ inches, Ans.

34. $7957.75 \times 25000 = 198943750$ square miles, Ans.

36. $40 \times 40 = 1600$; $1600 \div 3 = 533.3333+$; $\sqrt{533.3333} = 23.09+$ inches, Ans.

37. $20 \times 20 = 400$; $400 \div 3 = 133.3333+$; $\sqrt{133.3333} = 11.547+$; $11.547 \times 11.547 \times 11.547 = 1539.6+$ inches, Ans.

38. $10\text{ft.} = 120\text{in.}$; $5\text{ft.} = 60\text{in.}$; $4\text{ft.} = 48\text{in.}$; $120 \times 60 \times 48 = 345600$; $345600 \div 231 = 1496\frac{24}{231}$ gal. Ans.

39. $12\text{ft.} = 144\text{in.}$; $6\text{ft.} = 72\text{in.}$; $2\text{ft.} = 24\text{in.}$; $144 \times 72 \times 24 = 248832\text{in.}$; $248832 \div 282 = 882\frac{18}{47}$ gal. Ans.

40. $15\text{ft.} = 180\text{in.}$; $5\text{ft.} = 60\text{in.}$; $7\text{ft.} = 84\text{in.}$; $180 \times 60 \times 84 = 907200\text{in.}$; $907200 \div 2150.42 = 421.8+$ bushels, Ans.

42. $40 - 30 = 10$; $10 \times .65 = 6.5$; $30 + 6.5 = 36.5$; $36.5 \times 36.5 = 1332.25$; $1332.25 \times 50 = 66612.5$; $66612.5 \div 359 = 185.55+$ gal. Ans.

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43. $40 \times 30 = 1200$; $40 - 30 = 10$; $10 \times 10 = 100$; $100 \div 3 = 33\frac{1}{3}$; $1200 + 33\frac{1}{3} = 1233\frac{1}{3}$; $1233\frac{1}{3} \times 50 = 61666.66+$; $61666.66 \div 294 = 209.7+$ gal. Ans.

SECTION LXVI.

TONNAGE OF VESSELS.

1. (p. 265.) $65 \times 20 \times 10 = 13000$; $13000 \div 95 = 136\frac{8}{19}$ tons, Ans.

2. $70 \times 24 \times 12 = 20160$; $20160 \div 95 = 212\frac{4}{19}$ tons, Ans.

3. $\frac{3}{5}$ of $30 = 18$; $70 - 18 = 52$; $52 \times 30 \times 9 = 14040$; $14040 \div 95 = 147\frac{15}{19}$ tons, Ans.

4. $\frac{3}{5}$ of $22 = 13.2$; $75 - 13.2 = 61.8$; $61.8 \times 22 \times 12 = 16315.2$; $16315.2 \div 95 = 171\frac{3}{4}\frac{5}{7}\frac{1}{5}$ tons, Ans.

5. $\frac{3}{5}$ of $35 = 21$; $98 - 21 = 77$; $77 \times 35 \times 17\frac{1}{2} = 47162.5$; $47162.5 \div 95 = 496\frac{17}{38}$ tons, Ans.

6. $\frac{3}{5}$ of $40 = 24$; $180 - 24 = 156$; $156 \times 40 \times 20 = 124800$; $124800 \div 95 = 1313\frac{3}{19}$ tons, Ans.

7. $\frac{3}{5}$ of $21 = 12.6$; $78 - 12.6 = 65.4$; $65.4 \times 21 \times 9 = 12360.6$; $12360.6 \div 95 = 130\frac{5}{4}\frac{8}{7}\frac{8}{5}$ tons, Ans.

8. $\frac{3}{5}$ of $30 = 18$; $159 - 18 = 141$; $141 \times 30 \times 15 = 63450$; $63450 \div 95 = 667\frac{17}{19}$ tons, Ans.

9. $\frac{3}{5}$ of $80 = 48$; $479 - 48 = 431$; $431 \times 80 \times 48 = 1655040$; $1655040 \div 95 = 17421\frac{9}{19}$ tons, Ans.

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SECTION LXVII.

MENSURATION OF LUMBER.

1. (p. 257.) $24 \times 8 = 192$; $192 \div 12 = 16$ feet, Ans.
2. $30 \times 16 = 480$; $480 \div 12 = 40$ feet, Ans.
3. $3 \times 5 \times 15 \times 3 = 675$; $675 \div 12 = 56\frac{1}{4}$ feet, Ans.
4. $2 \times 6 \times 10 \times 20 = 2400$; $2400 \div 12 = 200$ feet, Ans.
5. $40 \div 4 = 10$; $10 \times 10 = 100$; $100 \times 30 = 3000$; $3000 \div 144 = 20\frac{5}{6}$ feet, Ans.
6. $56 \div 4 = 14$; $14 \times 14 = 196$; $196 \times 50 = 9800$; $9800 \div 144 = 68\frac{1}{18}$ feet, Ans.
7. $120 \div 4 = 30$; $30 \times 30 = 900$; $900 \times 90 = 81000$; $81000 \div 144 = 562\frac{1}{2}$ feet, Ans.

SECTION LXVIII.

PHILOSOPHICAL PROBLEMS.

2. (p. 267.) $1 \times 1 : \frac{1}{4} \times \frac{1}{4} :: 39.2 : 2\frac{9}{20}$in. Ans.
3. $1 \times 1 : 60 \times 60 :: 39.2 : 141120$in.; $141120 \div 12 = 11760$; $11760 \div 3 = 3920$yd. Ans.
4. $39.2 : 100 \times 12 :: 1 \times 1 : 30.6122$; $\sqrt{30.6122} = 5.53$sec. Ans.
5. $2000 + 4000 = 6000$; $6000^2 : 4000^2 :: 900$lb : 400lb. Ans.
6. $20000 + 4000 = 24000$; $24000^2 : 4000^2 :: 144$lb. : 4lb. Ans.
7. $1 : 2 :: 4000^2 : 32000000$; $\sqrt{32000000} = 5656.85$; $5656.85 - 4000 = 1656.85$ miles, Ans.

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8. $4000^2 : 240000^2 :: 150\text{lb.} : 540000\text{lb.}$ Ans.

9. $400 : 900 :: 4000^2 : 36000000$; $\sqrt{36000000} = 6000$; $6000 - 4000 = 2000$ miles, Ans.

10. $2180^3 = 1036023200$; $1036023200 \times 494 = 511795460800$ = cube of the moon's diameter multiplied by its density; $7964^3 = 505139057344$; $505139057344 \times 400 = 202055622937600$ = cube of the earth's diameter multiplied by its density. $511795460800 : 202055622937600 :: 6 : 236.8+$feet, Ans.

11. $2654 \times 400 = 1061600 = \frac{2}{3}$ of the earth's semi-diameter multiplied by its density;
$294415 \times 100 = 29441500 = \frac{2}{3}$ of the sun's semi-diameter multiplied by its density;
$26347 \times 67 = 1765249 = \frac{2}{3}$ of Saturn's diameter multiplied by his density;
$29723 \times 94.5 = 28088235 = \frac{2}{3}$ of Jupiter's diameter multiplied by his density;
$726 \times 494 = 358644 = \frac{2}{3}$ moon's diameter multiplied by its density.

$1061600 : 29441500 :: 170\text{lb.} : 4714.6+\text{lb.}$ = the man's weight at the sun;
$1061600 : 1765249 :: 170\text{lb.} : 282.6+\text{lb.}$ = the man's weight at Saturn;
$1061600 : 28088235 :: 170\text{lb.} : 449.7+\text{lb.}$ = the man's weight at Jupiter;
$1061600 : 358644 :: 170\text{lb.} : 57.4+\text{lb.}$ = the man's weight at the moon; } Ans.

13. $1^2 : 60^2 = 3600 :: 16\text{ft.} : 10\text{m. } 1600\text{yd.}$ Ans.

14. $1^2 : 3600^2 = 12960000 :: 16\text{ft.} : 39272\text{m. } 1280\text{yd.}$ Ans.

15. $24 \times 60 \times 60 \times 9 = 777600$ = seconds in 9 days; $1^2 : 777600^2 = 604661760000 :: 16\text{ft.} : 9674588160000\text{ft.}$; $9674588160000 \div 3 = 3224862720000\text{yd.}$; $3224862720000 \div 1760 = 1832308363\text{m. } 1120\text{yd.}$ Ans.

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16. $660 \div 8 = 82\frac{1}{2}$; $82\frac{1}{2} \times 82\frac{1}{2} = 6806\frac{1}{4}$ft. Ans.

17. $1000 \div 8 = 125$; $125 \times 125 = 15625$ft.; $15625 \div 5280 = 2$m. 5065ft. Ans.

18. $200 \div 8 = 25$; $25 \div 4 = 6\frac{1}{4}$sec. Ans.

19. $320 \div 8 = 40$; $40 \div 4 = 10$sec. Ans.

20. $\sqrt{40000} = 200$; $200 \div 4 = 50$sec. Ans.

21. $\sqrt{400} = 20$; $20 \div 4 = 5$sec. Ans.

23. $64 \times 64 = 4096$; $\sqrt{4096} = 64$; $64 \times 2240 \times 4 = 573440$lb. Ans.

SECTION LXIX.

MECHANICAL POWERS.

1. (p. 272.) 1lb. : 9lb. :: 170lb. : 1530lb. Ans.

2. 9lb. : 1lb. :: 1530lb. : 170lb. Ans.

3. 170lb. : 1530lb. :: 1lb. : 9lb. Ans.

4. 1530lb. : 170lb. :: 9lb. : 1lb. Ans.

5. 4.000.000.000.000.000.000.000 × 100 = 400.000.000.000.000.000.000.000; 200lb. : 400.000.000.000.000.000.000.000lb. :: 6000 miles : 12.000.000.000.000.000.000.000 miles, Ans.

6. 6000m. : 12.000.000.000.000.000.000.000.000m. :: 1in. : 2.000.000.000.000.000.000.000in.; $2.000.000.000.000.000.000.000 \div 12 = 166.666.666.666.666.666.666\frac{2}{3}$ft.; 100ft. : 166.666.666.666.666.666.666 :: 1sec. : 1.666.666.666.666.666.666$\frac{2}{3}$sec.; $1.666.666.666.666.666.666 \div 60 = 27.777.777.777.777.777$m. $46\frac{2}{3}$sec.; $27.777.777.777.777.777 \div 60 = 462.962.962.962.962$h. 57m.; $462.962.962.962.962 \div 8766 = 52.813.479.690$y. 17da. 14h. 57m. $46\frac{2}{3}$sec. Ans.

7. 4ft. = 48in. : 6in. :: 960lb. : 120lb. Ans.

8. 6in. : 48in. :: 120lb. : 960lb. Ans.

9. 120lb. : 960lb. :: 6in. : 48in. = 4ft. Ans.

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10. 960lb. : 120lb. :: 48in. : 6in. Ans.

11. 400lb. ÷ 2 = 200lb. Ans.

12. 2 × 3 × 10 = 60lb. Ans.

13. 2 × 2 × 144 = 576lb. Ans.

14. 6in. : 60in. :: 1 : 10; 144lb. × 2 × 2 × 10 = 5760lb. Ans.

15. 1000lb. × 10 = 10.000; 10.000 ÷ 50 = 200lb. Ans.

16. 1728lb. × 5 = 8640; 8640 ÷ 600 = $14\frac{2}{5}$lb. Ans.

17. 20000lb. × 50ft. = 1000000; 1000000 ÷ 5280 = $189\frac{2}{33}$lb. Ans.

18. 1 : 3.141592in. × 10 × 2 × 12 :: 100lb. : 75398.208 + lb. Ans.

19. 3.141592 × 2 × 100 : $\frac{1}{2}$in. :: 100000lb. : 79.5774 + lb. Ans.

20. $\frac{1}{2}$in. : 3.141592in. × 200 :: 79.5774 + lb. : 100.000lb. Ans.

21. 100.000lb. : 79.5774 + lb. :: 3.141592in. × 2 × 100 : $\frac{1}{2}$in. Ans.

22. 79.5774 + lb. : 100.000lb. :: $\frac{1}{2}$in. : 628.3184 + in.; 628.3184 ÷ 3.141592 = 200in.; 200 ÷ 2 = 100in. Ans.

23. 2in. : 20in. :: 100lb. : 1000lb. Ans.

24. .75in. : 3.141592 × 16 × 2 × 12 :: 200lb. : 3216990.208lb.; 15in. : 12in. :: 3216990.208lb. : 2573592.116lb. Ans.

SECTION LXX.

SPECIFIC GRAVITY.

1. (p. 277.) 10lb. — $6\frac{1}{6}$lb. = $3\frac{5}{6}$lb.; $3\frac{5}{6}$lb. : 10lb. :: 1000oz. : 2608.6 + oz. Ans.

2. 18lb. — 16lb. = 2lb.; 15lb. + 18lb. = 33lb.; 33lb. — 6lb. = 27lb.; 27lb. — 2lb. = 25lb.; 25lb. : 15lb. :: 1000oz. : 600oz. Ans.

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SECTION LXXI.

ASTRONOMICAL PROBLEMS.

3. (p. 278.) $1841 \div 4 = 460$; $1841 + 460 = 2301$; $2301 \div 7 = 328$, and 5 remainder; $8 - 5 = 3 = C$, Ans.

4. $1899 \div 4 = 474$; $1899 + 474 = 2373$; $2373 \div 7 = 339$, and 0 remainder; therefore A, Ans.

5. $1896 \div 4 = 474$; $1896 + 474 = 2370$; $2370 \div 7 = 338$, and 4 remainder; $8 - 4 = 4 = D$ and E, Ans.

6. $1786 \div 4 = 446$; $1786 + 446 = 2232$; $2232 \div 7 = 318$, and 6 remainder; $7 - 6 = 1 = A$, Ans.

7. $1837 \div 4 = 459$; $1837 + 459 = 2296$; $2296 \div 7 = 328$, remainder 0; therefore A, Ans.

MISCELLANEOUS QUESTIONS

1. (p. 279.) $6\frac{2}{3} \div 7\frac{3}{5} = \frac{5}{7}\frac{0}{}$ Ans.

2. $4\frac{1}{2} \times 2 = 9$; $\sqrt{9} = 3$ Ans.

3. $11\frac{3}{7} \times 5 = 57\frac{1}{7}$ Ans.

4. $9\frac{4}{7} \div 7\frac{3}{4} = 1_{2}^{5}\frac{1}{7}$ Ans.

5. $\frac{7}{19\frac{3}{5}} = \frac{3}{9}\frac{5}{8} = \frac{5}{14}$ Ans.

6. $\frac{4}{7}$ of a ton $=$ 11cwt. 1qr. 20lb.; $\frac{9}{10}$ of a cwt. $=$ 3qr. $16\frac{4}{5}$lb.; 11cwt. 1qr. 20lb. $+$ 3qr. $16\frac{4}{5}$lb. $=$ 12cwt. 1qr. $8\frac{4}{5}$lb. Ans.

7. 360° : 1° :: 23h. 56m. 3sec. : 3h. 59m. 20 + sec. Ans.

8. $\frac{2}{7} \times \frac{5}{9} = \frac{1}{6}\frac{0}{3}$; $\frac{1}{1} - \frac{1}{6}\frac{0}{3} = \frac{5}{6}\frac{3}{3}$ Ans.

9. $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$; $\frac{1}{3} = \frac{4}{12}$; $\frac{1}{4} = \frac{3}{12}$;

$\frac{7}{12} : \frac{4}{12} :: \$100.000 : \$57142\frac{6}{7}$ A's part,
$\frac{7}{12} : \frac{3}{12} :: \$100.000 : \$42857\frac{1}{7}$ B's part, } Ans.

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10. $\frac{12}{13} \times \frac{6}{1} = \frac{72}{13} = 5$h. 32m. $18\frac{6}{13}$sec. Ans.

NOTE.—We use the fraction $\frac{12}{13}$, because the minute-hand passes the hour-hand thirteen times in twelve hours.

11. As there is a son and a daughter, the son will have $\frac{4}{7}$ of the estate, the wife $\frac{2}{7}$, and the daughter $\frac{1}{7}$. If there had been only a daughter, her share would have been $\frac{2}{8}$; consequently she loses $\frac{2}{8} - \frac{2}{7} = \frac{8}{21}$. Hence

$$\frac{8}{21} : \frac{7}{21} :: \$2400 : \$2100 \text{ Ans.}$$

12. If the first man's share be subtracted from the whole, there will remain $\frac{18}{18} - \frac{7}{18} = \frac{11}{18}$; and $\frac{7}{18}$ of $\frac{11}{18} = \frac{77}{324}$ = the second son's share. And $\frac{7}{18} - \frac{77}{324} = \frac{49}{324}$ = difference of their legacies. $\frac{7}{18} = \frac{126}{324}$; $\frac{126}{324} + \frac{77}{324} = \frac{203}{324}$ = legacy of both sons. Hence $\frac{324}{324} - \frac{203}{324} = \frac{121}{324}$ = wife's legacy. Therefore

$$\frac{49}{324} : \frac{121}{324} :: 257£.\ 3s.\ 4d. : 635£.\ 0s.\ 10\frac{30}{49}d. \text{ Ans.}$$

13. $63 \times 12 \times 12 \times 1000 \times 3 = 27216000$; $27216000 \div 16 = 1701000$lb.; $1701000 \div 2240 = 759\frac{3}{8}$ tons, Ans.

14. 4ft. = 48in.; 6in. $\times 2 = 12$in.; $48 - 12 = 36$in.; $36 \div 2 = 18$in.; $18 + 12 = 30$in.; 48in. : 18in. :: 200lb. : 75lb. Ans. $48 - 30 = 18$in.; 48in. : 18in. :: 200lb. : 75lb. Ans.

15. To perform this question, we first find how long each pillar must be to terminate in a cone. We then find the contents of the whole cone, from which we subtract the part that is applied to complete the cone, and the remainder is the contents of each pillar. 25ft. 4in. = 304in.; 4ft. 5in. = 53in.; 3ft. 5in. = 41in.; $53 - 41 = 12$in. = difference of the diameters of the ends of the pillars. 12in. : 53in. :: 304in. : 1611$\frac{2}{3}$in. = 1342$\frac{2}{3}$ft. = length of the larger cone; $1342\frac{2}{3} - 304 = 1038\frac{2}{3}$in. = length of the smaller cone. $53 \times 53 \times .785398 = 2206.182982$in. = area of the base of the larger cone. $2206.182982 \times 1342\frac{2}{3} = 2962168.350498$; $2962168.350498 \div 3 = 987389.450166$ = contents of the larger cone; $987389.450166 \times 8 =$

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7899115.601328 = contents of 8 cones; $41 \times 41 \times .785398$ = 1320.254038 = area of the base of the smaller cone; $1320.254038 \times 1038\frac{2}{3}$ = 1371303.860802; 1371303.860802 ÷ 3 = 457101.286934 = contents of the smaller cone; 457101.286934 × 8 = 3656810.295472 = contents of the 8 smaller cones. We now proceed to subtract the contents of the 8 smaller cones from the contents of the 8 larger cones, and the remainder will be the contents of the pillars required by the question. 7899115.601328 — 3656810.295472 = 4242305.305856in. = contents in cubic inches of the pillars; 4242305.305856 ÷ 1728 = 2455.036126 = cubic feet in the pillars, Ans. 2455.036126 × 3000 = 7365108.378 = weight in ounces; 7365108.378 ÷ 16 = 460319.2736 pounds; 460319.2736 ÷ 2240 = 205.49967 + tons, Ans.

16. If $\frac{3}{7}$ of a certain sum be taken, and $410 be left, it is evident that $410 is $\frac{4}{7}$ of that sum, which is $\overline{410 \times 7} \div 4 =$ $717\frac{1}{2}$. Now, if $717\frac{1}{2}$ remain of a certain quantity after $\frac{1}{4}$ be subtracted, it is certain that the number from which it is taken is $\frac{4}{3}$ of $717\frac{1}{2} =$ $956.66\frac{2}{3}$ Ans.

17. $\frac{1}{4}$: $15.60 :: $100 : $6240 = sum remitted; $96 : $100 :: $6240 : $6500 = value of goods sold; $6500 — $6240 = $260 = commission, Ans.

18. $107.50 : $100 :: $9675 : $9000; $\frac{9}{40} \times$ $9000 = 2025£$. sterling = the bill; $100 — $0.25 = $99.75;

$100 : $99.75 :: $9675 : $9650.81\frac{3}{4}$;

$102 : $100 :: $9650.81\frac{3}{4}$: $9461.58\frac{3}{34}$ for investment, Ans.

19. The same principle is adopted to perform this question, as was used in the operation of the 15th. As the monument, at the height of 220 feet, has half the diameter at the top, that it has at its base, it is evident, that, if it were raised to 440 feet, it would terminate in a point. The cylindrical avenue in the centre of the monument, being 15 feet diameter at the base, and 11 feet at the height of 220 feet, must be 825 feet in length before it terminates in

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a point, as may be seen in the following operation; $15-11=4$ft.; 4ft. : 15ft. :: 220ft. : 825ft. length of the cylinder, terminated in a cone; $15\times15\times.785398=176.71455$ft.; $176.71455\times825=145789.50375$ft.; $145789.50375\div3=48596.50125$ft. contents of the whole cone; 825ft.-220ft.$=605$ft.$=$length of the cone above the monument; $11\times11\times.785398=950.33158$ft.; $950.33158\times605=57495.06059$ft.; $57495.06059\div3=19165.020196$ft. contents of the small cone; $48596.50125-19165.020196=29431.481054$ft. contents of the frustrum of the cone within the monument; $30\times30\times440=396000$ft.; $396000\div3=132000$ft. contents of the monument raised to a point at the height of 440ft.; $15\times15\times220=49500$ft.; $49500\div3=16500$ft. $=$ contents of the square pyramid above the monument; $132000-16500=115500$ft. contents of the monument without deducting the cylinder; 115500ft.-29431.481054ft.$=86068.518946$ cubic feet of the monument, that *is to be*, Ans.

20. $\frac{4}{12}\times1+\frac{4}{12}\times\frac{1}{2}+\frac{4}{12}\times\frac{1}{3}=\frac{22}{36}$ A's product;
$\frac{4}{12}\times\frac{1}{2}+\frac{4}{12}\times\frac{1}{3}=\frac{10}{36}$ M's product;
$\frac{4}{12}\times\frac{1}{3}=\frac{4}{36}$ P's product;
$\frac{36}{36}$ sum of the products.

$\frac{36}{36}$: \$300 :: $\frac{22}{36}$: \$183.33$\frac{1}{3}$ = A pays,
$\frac{36}{36}$: \$300 :: $\frac{10}{36}$: \$ 83.33$\frac{1}{3}$ = M pays,
$\frac{36}{36}$: \$300 :: $\frac{4}{36}$: \$ 33.33$\frac{1}{3}$ = P pays, } Ans.

21.

A	$20\times\$132=\$2640$	
B	$25\times\$120=\$3000$	$85\times\$6=\$510$
C	$40\times\$100=\$4000$	
	85	\$9640

\$9640 : \$510 :: \$2640 : \$139$\frac{161}{241}$ A receives,
\$9640 : \$510 :: \$3000 : \$158$\frac{172}{241}$ B receives,
\$9640 : \$510 :: \$4000 : \$211$\frac{149}{241}$ C receives, } Ans.

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22. $\$100 \times \$5.00 = \$500$ given for the flour;
$\$500 \times \$0.20 = \$100$ gained on the flour.

$\$600$

$\$100 \times \$0.03.0\frac{1}{2} = \$3.05$ bank interest of $\$100$ for 6 months;
$\$100 - \$3.05 = \$96.95 : \$100 :: \$600 : \$618\frac{168}{1939}$;
$\$618\frac{168}{1939} \div 100 = \$6.18\frac{168}{1939}$ Ans.

23. $5\frac{1}{4} \times 1\frac{7}{8} = 3\frac{15}{32}$ square yards of broadcloth; $\frac{7}{8} - \frac{1}{4} \times \frac{1}{4} = \frac{7}{8} - \frac{1}{16} = \frac{13}{16}$yd. = width of flannel after being shrunk; $3\frac{15}{32} \div \frac{13}{16} = \frac{504}{416} = 12\frac{3}{26}$yd. = length of flannel necessary to line the broadcloth if it had not shrunk in *length;* 19yd. : 20yd. :: $12\frac{3}{26}$yd. : $12\frac{188}{247}$yd. quantity necessary to buy, Ans.

24. $40 \times 2 = 80$ft.; $30 - 2 = 28$ft.; $28 \times 2 = 56$ft.; $80 + 56 = 136$ft.; $136 \times 20 = 2720$ cubic feet; $2720 \times 1728 = 4700160$ cubic inches in the walls of the building; $8 \times 4 \times 2 = 64$ cubic inches in a brick; $4700160 \div 64 = 73440$ brick, Ans.

25. As the roof projects 1ft. over the plate, it will be 42ft. square; $42 \div 2 = 21$ft.; $21 \times 21 = 441$ft.; $15 \times 15 = 225$ft.; $441 + 225 = 666$ft.; $\sqrt{25.8068} +$ feet, being the distance from the top of the house to the plate; $25.8068 \div 2 = 12.6034$ft.; $12.6034 \times 41 \times 4 = 2167.7712$ square feet in the roof; $40 + 40 = 80$ft.; $80 \times 2 = 160$ft.; $160 \times 20 = 3200$ft. required to cover the body of the house; $3200 + 2167.7712 = 5367.7712$ square feet of boards necessary to cover the house, Ans.

26. $18.5 \times 18.5 \times 18.5 \times 8 = 50653$; $\sqrt[3]{50653} = 37$in. wide; $8 \times 8 \times 8 \times 8 = 4096$; $\sqrt[3]{4096} = 16$in. deep, Ans.

27. As the metal is 1 inch thick, the diameter of the *inner* sphere is 3 inches; $5 \times 5 \times 5 \times .5236 \times \frac{128}{500} = 16.8861$lb. weight of the shell, if it were solid iron; $3 \times 3 \times 3 \times .5236 \times \frac{128}{500} = 3.6473976$lb. weight of the inner sphere, if it were iron; $16.8861 - 3.6473976 = 13.2387 +$ lb. Ans.

28. By Position. — Suppose the time to be 16 minutes past 2 o'clock, the hour-hand must have passed $\frac{16}{60}$ of the dis-

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tance from 2 o'clock to 3 o'clock; and if the minute-hand were in the place of the hour-hand, it would be 11m. 20sec. from 12 o'clock. And if the hour-hand were in the place of the minute-hand, the time would be 12 minutes past 3 o'clock. The difference between 12m. and 11m. 20sec. is 40sec. Let these be the first error. Again, suppose the time to be 18 minutes past 2 o'clock; the hour-hand, at that time, has passed $\frac{18}{60}$ of the distance from 2 o'clock to 3 o'clock; and if the minute-hand were in the place of the hour-hand, it would be 11m. 30sec. from 12 o'clock. And if the hour-hand were in the place of the minute-hand, the time would be 36 minutes past 3 o'clock. The difference between 36m. and 11m. 30sec. is 24m. 30sec. = 1470sec. Let these be the second error. Both errors are plus. We now proceed as in the operation:—

16 40+
18 1470+
40 16
720 23520
−720

1470—40=1430) 22800 (15m. $56\frac{22}{143}$sec. past 2 o'clock, A.
1430
8500
7150
1350
60

1430) 81000 ($56\frac{22}{143}$sec.
71500
9500
8580
920

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By Analysis. — Let the annexed diagram represent the face of a clock; A, or 60, the 12 o'clock mark; B, 5 minutes; C, 10 minutes; F, 15 minutes; H, 20 minutes, &c. round the same. Suppose, then, the two hands to be together at A, and then the minute-hand to be moved forward $2\frac{1}{4}$ times round, and it will be at F, having moved 135 minutes; and the hour-hand will have moved to a point, which call D, between C and F. Suppose, then, the minute-hand to be moved still forward to the place required by the supposition, between F and H, which place call G. The hour-hand will then have moved to its place required between C and F, which place call E. Then, D E being $\frac{1}{12}$ of F G, and F G being $\frac{1}{12}$ of A E, it is evident that D E $= \frac{1}{12}$ of $\frac{1}{12}$ A E, that is, $\frac{1}{144}$ part of A E; and A D is the other $\frac{143}{144}$ of A E; and so, while the minute-hand moves from A twice round, and to G, the hour-hand moves from A to E; and while the minute-hand moves from A to E, the hour-hand moves from F to G; therefore, as 143 : 144 :: 135m. : $135\frac{135}{143}$m. = 2h. $15\frac{135}{143}$m. = the time at which the hands were in the first position, the minute-hand being $\frac{135}{143}$ of a minute beyond the 3 o'clock mark. Again, $135\frac{135}{143}$m. $\div$ 12 = $11\frac{47}{143}$m. = the minute on the face where the hour-hand was at first. Again, $15\frac{135}{143}$m. — $11\frac{47}{143}$m. = $4\frac{88}{143}$m. = the minutes between the two hands. Again, 60m. — $4\frac{88}{143}$m. = $55\frac{55}{143}$ = the time between the hands changing places; and 2h. $15\frac{135}{143}$m. + $55\frac{55}{143}$m. = 3h. $11\frac{47}{143}$m. = the time on the clock when the hands would have changed places; and $11\frac{47}{143}$m. $\div$ 12 = $\frac{135}{143}$ of 1 minute

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= place of the hour-hand beyond the 3 o'clock mark at the time of changing places, Q. E. D.

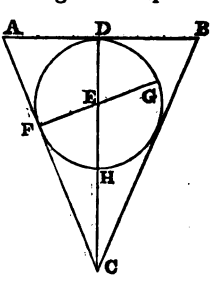
29. $20\times20\times20=8000$ cubic inches = contents of the larger cube. $20\times20=400$; $400\div3=133.33+$; $\sqrt{133.3}=11.5469+$; $\overline{11.5469}^3+=1539.58+$ cubic inches = contents of the smaller cube, Ans.

30. $90\times40=3600$; $\sqrt{3600}=60$lb. true weight, Ans. $90-60=30$lb.; $60-40=20$lb.; 30lb. : 20lb. : : 3ft. : 2ft.; that is, the arms of the scales are to each other as 2ft. to 3ft. Ans.

31. Both wheels being of the same height, and the outer wheel making two turns, while the inner one makes only one turn, it will follow, that the outer ring will be twice the diameter of the inner ring. The distance between the rings being 5 feet; and the circumferences of circles being as their diameters, it will also follow, that the diameter of the inner ring will be 10 feet, and the diameter of the outer ring 20 feet. And if the diameter be 20 feet, the circumference will be 62.83 + feet, Ans.

32. $6\times6\times6\times144\times.5236\times3\frac{1}{2}=57001$d. = 237£. 10s. 1d. Ans.

33. The annexed diagram may represent the conical glass, A B C being the cone, and F D G H a globe or sphere immersed in it. If A B be 5 inches, A D will be 2.5 inches, because A D is half of A B. A D C is a right-angled triangle; therefore the side A C may be found; thus, $\sqrt{AD^2+DC^2}=AC$; $\sqrt{\overline{2.5\times2.5}+\overline{6\times6}}=6.5=AC$. Because A D E F is a regular figure; and, the angles A D E and A F E being equal, each being a right angle, and the sides D E and F E being also equal, because they are



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radii of the circle D F H G, the sides A D and A F are also equal. A D is 2.5 inches; A F is also 2.5 inches. If A C be 6.5 inches, and A F 2.5 inches, F C will be 4 inches; 6.5 — 2.5 = 4 inches. Then, by similarity of triangles (see page 202), C D : D A :: C F : F E; 6in. : 2.5in. :: 4in. : $1\frac{2}{3}$in. = F E. If F E be $1\frac{2}{3}$in., F G will be $3\frac{1}{3}$in. = $\frac{10}{3}$in., because F G is the diameter of the sphere, and F E the radius or semi-diameter. By mensuration of solids (see pages 260 and 262), we find the contents of the cone and sphere in the following manner:

$5 \times 5 \times .785398 \times 2 = 39.2699$in. = contents of the cone;
$\frac{10}{3} \times \frac{10}{3} \times \frac{10}{3} \times .5236 = 19.3925$in. = contents of the sphere;
19.8774in. = the cubic inches of

water that will remain in the cone after the sphere is immersed. Having taken it for "granted," that cones, spheres, and all regular solid bodies, are to each other as the cubes of their homologous sides, we say, As the quantity of water it requires to immerse the sphere in the *given* cone is to the cube of the diameter of the sphere, so is any other quantity of water in the conical glass to the cube of the diameter of a sphere that may be immersed in it. Now, the quantity of water given to immerse the *required* sphere is $\frac{1}{5}$ of the contents of the conical glass = $\frac{39.2699}{5}$ = 7.85398 cubic inches. The cube of the diameter of the *given* sphere is $\frac{10}{3} \times \frac{10}{3} \times \frac{10}{3} = \frac{1000}{27}$in. Therefore

19.8774in. : $\frac{1000}{27}$in. :: 7.85398in. : 14.634114529 + in.;

$\sqrt[3]{14.634114529} = 2.445 +$ in. Ans.

34. Let the larger circle of the annexed figure represent the farm of the lady, and the three smaller circles the farms of her daughters. To construct this figure, make the equilateral triangle C B D, each of whose sides is 10 rods or inches. Bisect each of the sides D C, C B, B D,

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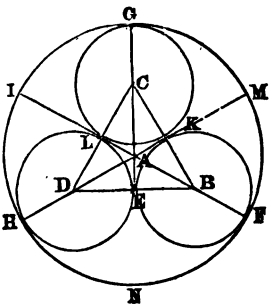

in the points L, E, K; and draw the lines I F, E G, F I, at pleasure. Upon the points C, D, B, as centres, and with the distance C L, as a radius, describe the circles G L K, L H E, K E F. Upon the point A, as a centre, where the lines I F and H M intersect each other, and with the radius A G, describe the circle G I H N F M, and it will touch the peripheries of the smaller circles without cutting them. The sides of the triangle being 10, the diameter of each of the smaller circles will be 10. Because C D E is a right-angled triangle, $CE = \sqrt{CD^2 - DE^2}$; $\sqrt{10 \times 10 - 5 \times 5} = 8.660254+$; and as C D E and A D E are similar triangles, C E : C D :: D E : D A; that is, 8.660254 : 10 :: 5 : 5.7735027 = A D. If we add H D = 5 to D A, we have the semi-diameter of the larger circle, 5.7735027 + 5 = 10.7735027. By multiplying this last number by 2, we have the diameter of the larger circle, 10.7735027 × 2 = 21.5470054. As the area of a circle may be found by multiplying the square of the diameter by .785398, therefore, by dividing the area by .785398, the quotient will be the square of the diameter. The area of the lady's field is 500 acres = 80000 square rods; 80000 ÷ .785398 = 101859.28 square of the diameter; $\sqrt{101859.28} = 319.154006+$ rods = diameter of the lady's farm. To find the diameter of each of the daughters' farms, we say, As the diameter of the larger circle in the diagram is to the diameter of one of the smaller circles in the diagram, so is the diameter of the lady's farm to the diameter of either of her daughters' farms. 21.5470054rd. : 10rd. :: 319.154006rd. : 148.119889 + rd. = diameter of the daughters' farms; and the distance of their houses from each other, 148.119889 × 148.119889 ×

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.785398 = 17231.2406 + square rods in each of the daughters' farms; 17231.24 + rd. ÷ 160 = 107A. 2R. 31.24 + rods = acres, &c. in each of their farms; 107A. 2R. 31.24 × 3 = 323A. 0R. 13.72 amount of the 3 daughters' farms; 500A. — 323A. 0R. 13.72rd. = 176A. 3R. 26.28rd. the lady retained. To find the distance of the lady's dwelling-house from those of her daughters, we subtract the semi-diameter of either of the daughters' farms from that of the lady's; thus, 319.154 + rd. ÷ 2 = 159.577 + rd.; 148.119 + rd. ÷ 2 = 74.059 + rd.; 159.577 + rd. — 74.059 + rd. = 85.518 + rd. Ans.

THE END.

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THE NATIONAL ARITHMETIC, on the inductive system; combining the Analytic and Synthetic methods, in which the principles of Arithmetic are explained and illustrated in a perspicuous and familiar manner; containing, also, practical systems of Mensuration, Gauging, Geometry, Book-keeping, &c., and much practical information connected with Trade and Commerce—forming a complete Mercantile Arithmetic. Designed for Schools and Academies throughout the United States. By Benjamin Greenleaf, A. M., Preceptor of Bradford Academy. New Stereotype Edition, with corrections and improvements.

ADVERTISEMENT TO THE SECOND (STEREOTYPE) EDITION.

The rapid and extensive sale of the first edition of the National Arithmetic, together with its flattering reception in various sections of our country, has induced the author thoroughly to revise and improve the work, which he trusts will give it additional merit.

The author believes that not an error or inaccuracy of essential importance will be found in the present (stereotype) edition, which could not be wholly avoided in the *first*.

It has been deemed expedient, that the new edition should embrace more of the inductive plan than the former, with the addition of much important and valuable matter.

The author has availed himself of the assistance of several experienced teachers, among whom he would acknowledge his obligations particularly to Mr. Charles H. Allen, one of the associate Principals of the Franklin Academy, Andover; and to Mr. David P. Page, Principal of the English High School, Newburyport; also to several mercantile gentlemen, who have afforded valuable suggestions of a practical nature.

Bradford, Nov. 5th, 1836.

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GREENLEAF'S NATIONAL ARITHMETIC.

☞ This work is highly approved and recommended by teachers who have used it, and its superior merits have already given it an introduction into many of the best Schools and Academies in the New England States, which is a favorable indication that it will assume a high rank in this department of science.

RECOMMENDATIONS.

From Mr. Page, Principal of the English High School, Newburyport.

Benjamin Greenleaf, Esq. Dear Sir: I have with much care examined the NATIONAL ARITHMETIC, of which you are the author, and after having compared it, *article by article*, with the various other publications that have come to my hands, I hesitate not to say, that I think it contains a greater amount of matter, and a better arrangement of subjects, than any other book I have seen. Your rules and explanations are clear and definite, and your examples are well calculated to fix them in the mind. I congratulate the community on this valuable accession to our list of school books; and shall take pleasure in seeing your Arithmetic extensively introduced into all our schools, as also into that under my own care. Yours, with just respect,

Newburyport, Mass. March 5, 1836. DAVID P. PAGE. .

The undersigned, members of the General School Committee, of Haverhill, take the liberty of recommending to the purchasers of books for the use of schools in this town, Greenleaf's National Arithmetic, as a work comprehending most of the advantages of the various treatises on the subject now before the public, and as more directly adapted to the practical interests of the community than any which have fallen under their notice.

GEO. KEELY, JOSEPH WHITTLESEY,
NATHL. GAGE, SAMUEL H. PECKHAM,
HENRY PLUMMER, ABIJAH CROSS,
Haverhill, 8th, 1st Month, 1836. JOHN G. WHITTIER.

From the Principal of Merrimack Academy.

Mr. B. Greenleaf. Dear Sir: I have examined your National Arithmetic, and am happy to say that it is truly a *practical* work. The *numerous* questions, both from their *nature* and *arrangement*, are well calculated to produce an increased interest, and to facilitate the acquisition of a thorough practical knowledge of this science. I have introduced it into my school, and the result has been, that the scholars have manifested a greater fondness for the study, and made more rapid progress, than when attending to books formerly in use.

I do most cheerfully recommend the work, believing it to be very happily adapted to the wants of our schools and academies.

Very respectfully, yours,

Bradford, Feb. 8, 1836. SYLVANUS MORSE.

From the Principal of the Young Ladies' High School, Boston.

Mr. Robert S. Davis. Sir: I have carefully examined Mr. Greenleaf's Arithmetic, and think it a valuable work. The arrangement is good; the rules are distinctly announced, in their natural order, and the examples are copious and well chosen. Very respectfully, yours, &c. E. BAILEY.

To Benjamin Greenleaf, A. M., Preceptor of Bradford Academy.

Sir: The School Committee of the town of Bradford, having examined your National Arithmetic, are of opinion that the various rules are well arranged, and the numerous operations judiciously selected; and that it is better adapted to the wants of our Academies and Schools than any Arithmetic now in common use, and do hereby recommend it to be used in the schools under our care.

JEREMIAH SPOFFORD, *Chairman of said Committee.*

Bradford, Feb. 12, 1836.

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GREENLEAF'S NATIONAL ARITHMETIC.

We have examined this work somewhat critically, and do not hesitate to pronounce it, in our opinion, the most *practical* and *complete* system of Arithmetic now before the public. As a mercantile assistant, it comes infinitely nearer to perfection than any other work within our recollection, and as applicable to common schools and academies, we believe its equal cannot be found. Plain, concise, and perspicuous, it is admirably adapted, in its progressive exercises, to the various stages of advancement to which the pupil is led.

We think the work cannot fail to receive that extensive patronage which it so justly deserves, and that the School Committee of this town will lose no time in introducing it into our schools.—*Fall River Patriot.*

From Mr. Stewart Chase, Principal of an Academy.

Newbury, May 11, 1836.

Mr. Greenleaf. Dear Sir: By the politeness of Mr. Page a copy of the National Arithmetic was put into my hands some months since, which I have thoroughly examined, and, from actual experiment with my scholars, I do not hesitate in giving it the preference to any work of the kind which has come under my inspection; and at the annual meeting of the school committee (of which I am a member) I laid the book before them, and it was voted unanimously to introduce it into our schools immediately.

Truly yours,

S. CHASE.

From Mr. Allen, of the Franklin Academy, Andover.

Boston, Jan. 15, 1836.

Mr. Robert S. Davis. Dear Sir: I have carefully examined the National Arithmetic, a copy of which you were kind enough to send me. I have delayed speaking decidedly of its merits, until a small class in my school had studied the more difficult parts of it. In my judgment, Mr. Greenleaf has very judiciously arranged the whole treatise. The plan of the work and its execution are so excellent, that it must rapidly acquire that favor which it so richly deserves.

CHARLES H. ALLEN.

From the Principal of Gilford (N. H.) Academy.

I know of no Arithmetic better suited to the wants of schools than this, either as a book to be used separately, or as a sequel to the mental Arithmetics in use. I hope, sir, your publication will receive that ample patronage which its merits demand, and you thereby be rewarded for the arduous labors you have bestowed upon it.

Respectfully yours,

DYER H. SANBORN.

From the Principal of Marblehead Academy.

To Mr. B. Greenleaf. Dear Sir: Having thoroughly examined your National Arithmetic, I am prepared to express my full approbation of its utility. The principles of the science are fully explained and admirably applied to mercantile computations. Several rules and tables, generally omitted in common Arithmetics, contribute greatly to enhance the value of the book, and recommend it to all who wish to acquire a thorough and practical knowledge of the common business of life.

With respect, your friend and servant,

RUSSELL L. HATHAWAY.

From the Preceptor of Hampton Falls (N. H.) Academy.

I have used the National Arithmetic the past season, and am much pleased with it; and upon thorough examination and comparison with others, I think it not only superior to any of them, but will answer as a substitute for nearly all the arithmetics now in use.

Very respectfully, yours,

Hampton Falls, April 5th, 1836.

OLIVER AYER.

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PROGRESSIVE EXERCISES IN ENGLISH COMPOSITION. By R. G. Parker, A. M., Principal of the Franklin Grammar School, Boston. Twelfth stereotype edition.

Since this popular work was first published, upwards of forty thousand copies have been called for in the United States, being used in the principal High Schools and Academies in *all* the states. The School Committee of Boston authorized its introduction into the Public Schools of the city, soon after the first edition was issued, and it is now the only work on Composition used in them. It is also the regular text book in the Public Schools of New York, Philadelphia, and other large cities. To show the estimation in which the work is held in foreign countries, the fact may be stated, that it has been republished and stereotyped in London, and *six* large editions have been sold there, which is strong evidence of its merit.

Among the public notices which have appeared in England, the following is annexed:

The design of this work is unexceptionably good. By a series of progressive exercises the scholar is conducted from the formation of easy sentences to the more difficult and complex arrangement of words and ideas. He is, step by step, initiated into the rhetorical propriety of the language, and furnished with directions and models for analyzing, classifying and writing down his thoughts in a distinct and comprehensive manner.—*London Jour. of Education.*

The following Recommendations, exhibiting the character of the work, from respectable sources in our own country, are selected from a large number in possession of the Publisher:

From Mr. Walker, Principal of the Eliot School, Boston.

This work is evidently the production of a thorough and practical teacher, and in my opinion it does the author much credit. By such a work all the difficulties and discouragements which the pupil has to encounter, in his first attempts to write, are in a great measure removed, and he is led on, progressively, in a methodical and philosophical manner, till he can express his ideas on any subject which circumstances or occasion may require, not only with sufficient distinctness and accuracy, but even with elegance and propriety. An elementary treatise on composition, like the one before me, is certainly much wanted at the present day. I think this work will have an extensive circulation, and I hope the time is not distant, when this branch of education, hitherto much neglected, will receive that attention which in some degree its importance demands.

From Walter R. Johnson, Esq., Philadelphia.

Having often felt the necessity of reducing to its simple elements the art of composition, and having been compelled, from the want of regular treatises, to employ graduated exercises expressly prepared for the purpose, and similar in many respects to those contained in your treatise, I can speak with confidence of their utility, and do not hesitate to recommend them to the attention of teachers.

From the Boston Evening Gazette.

Mr. Parker has certainly hit upon a most happy method of aiding the young student in one of the most useful, and one of the most difficult, parts of common school education, and we know of no recent school book, if it is generally used, that will be more serviceable to the rising generation, than the Progressive Exercises in English Composition.

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PARKER'S EXERCISES IN ENGLISH COMPOSITION.

From Rev. Mr. Burroughs, of Portsmouth, N. H.

I was much gratified by the receipt of your book, entitled Progressive Exercises in English Composition; and, if possible, still more so by its original, judicious and excellent plan. It is a valuable and successful attempt to give instruction in relation to one of the most difficult, though important departments of education; and I should conceive it would afford great pleasure, as well as benefit, to the minds of the young. I sincerely hope that it will be introduced into our schools, where such a work has been long wanted.

From Mr. Andrews, Professor of Mt. Vernon School, Boston.

Parker's Progressive Exercises in English Composition will, in my opinion, aid the teacher, and encourage the pupil, in this important branch of education. I feel confident that the work will be highly acceptable to those who have experienced the difficulties to be surmounted in bringing forward a class *to compose* with any degree of accuracy.

From Samuel P. Newman, Professor of Rhetoric in Bowdoin College.

I have examined "Progressive Exercises in English Composition," by R. G. Parker, with some care, and hesitate not to express an opinion that it is well adapted to the purpose for which it is designed. It is well fitted to call into exercise the ingenuity of the pupil, to acquaint him with the more important principles and rules of Rhetoric, and to guide and aid his first attempts in the difficult work of composition.

From Mr. Pike, late Preceptor of Framingham Academy.

I have recently put a class of boys into Mr. Parker's Progressive Exercises in Composition. They are deeply interested, and find much pleasure, and I trust profit, in passing from lesson to lesson. I have never before seen boys so much interested in "writing composition," usually esteemed one of the heaviest burdens imposed upon them.

From Dr. Fox, Principal of the Boylston School, Boston.

This little manual, by the simplicity of its arrangement, is calculated to destroy the repugnance, and to remove the obstacles which exist in the minds of young scholars to performing the task of composition. I think this work will be found a valuable auxiliary to facilitate the progress of the scholar, and lighten the labor of the teacher.

From Mr. Dillaway, Principal of the Latin School, Boston.

Their clearness and simplicity strongly recommend them to the instructers in this important branch of education.

From Mr. Oliver, Principal of the Salem Classical School.

I have introduced the work into this Institution, and heartily recommend it to the notice of the profession.

From Mr. Joseph Healy, of Pawtucket.

I think it a very valuable auxiliary in the cause of education.

From the R't Rev. G. W. Doane, Bishop of New Jersey, formerly Professor of Rhetoric and Oratory in Washington College.

Your little book on composition is excellent. It is the best help to that difficult exercise for the young that I have ever seen.

☞ The same author has in course of preparation *a Second Part*, or Sequel to the above popular school book, which will be published soon.

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THE CLASS BOOK OF ANATOMY, explanatory of the first principles of Human Organization, as the basis of Physical Education; with numerous Illustrations, a full Glossary, or explanation of technical terms, and practical Questions at the bottom of the page. By J. V. C. Smith, M. D., formerly Professor of General Anatomy and Physiology in the Berkshire Medical Institution. New Stereotype Edition, revised and enlarged.

☞ This work has received the highest testimonials of approbation from the most respectable sources, and has already been adopted as a text book in several schools and colleges in various sections of the United States.

The estimation in which it is held in other countries may be inferred from the fact, that a translation of it has recently been made into the Italian language, at Palermo, under the supervision of the celebrated Dr. Placido Portel. It is also in the progress of translation into the Hawaiian language, by the American missionaries at the Sandwich Islands, to be used in the higher schools, among the natives; and the plates are soon to be forwarded, with reference to that object, by the American Board of Commissioners for Foreign Missions; which furnishes conclusive evidence of its value and utility.

From Rev. Hubbard Winslow, Pastor of Bowdoin St. Church, Boston.

Boston, Nov. 7, 1836.

I have examined the Class Book of Anatomy, by Dr. Smith, with very great satisfaction. For comprehensiveness, precision, and philosophical arrangement, it is surpassed by no book of the kind which I have ever seen. The study of Anatomy and Physiology, to some extent, is exceedingly interesting and useful as a branch of common education; and it is to be desired that it should be more extensively adopted in all our higher schools. To secure this end, there is no other book before the public so well prepared as the one under remark. It is also a convenient compend to lie upon the table of the scientific anatomist and physician, and a very valuable family book for reference, and for explanation of terms which often occur in reading.

H. Winslow.

We are gratified to see the attempt to introduce a new subject to ordinary students. It is wonderful that civilized man has been so long willing to remain ignorant of the residence of his mind, and the instruments by which it operates. The book before us abounds in information in which every adult reader will feel a deep interest, and from which all may derive valuable lessons of a practical kind. We are gratified to see frequent references to the Great First Cause of life and motion. We cordially wish success to his enterprise in a path almost untrodden.—*American Annals of Education.*

Copy of a Communication from Mr. C. H. Allen, of the Franklin Academy, Andover, Mass.

North Andover, Dec. 10, 1836.

Mr. R. S. Davis. Dear Sir: During my vacation, I have had time to examine Smith's Class Book of Anatomy, the second edition of which you have recently published. I do not hesitate to speak of it as the very work which the public have long demanded. It contains knowledge which should be widely diffused. The author is remarkably clear in his explanations and descriptions, and very systematic in his arrangement. So that he has rendered this neglected branch of useful knowledge highly interesting to all classes.

Yours, respectfully,

Chas. H. Allen.

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SMITH'S CLASS BOOK OF ANATOMY.

From Rev. Charles Brooks, of Hingham, who alluded to this work, in very commendable terms, in a popular lecture on Education, delivered in the Massachusetts House of Representatives.

Mr. R. S. Davis. Dear Sir: Dr. Smith's "Class Book of Anatomy," which you was so kind as to send me, I have examined with pleasure and profit. It is the best book of the kind which I have seen. I wish every child in the United States could be made to see its uses. Did parents fully understand *physical education*, how much pain and illness would be prevented, and, moreover, how would intellectual and moral culture be advanced! Our community cannot come to its growth—we cannot have *whole* men, until ALL the physical, intellectual, and moral powers are developed in their natural order, proper time, and due proportion. In the hands of a competent teacher, this book will be one step's advance towards such a result.

Yours, respectfully,

Hingham, Feb. 20, 1837. CHARLES BROOKS.

Extract from a notice in the Boston Christian Watchman.

We think many of your readers will be pleased to know that a book on Anatomy is prepared for popular use, on such a plan. Why should a subject of such common interest be excluded from the great mass of general readers, and confined to the medical profession? The author, a professed anatomist, has conferred a great favor on this class, by presenting, in a form as simple as the nature of the subject would allow, a popular outline of an intricate science, and by preparing for his work plates and descriptions which are otherwise to be obtained only at great expense.

From Rev. George W. Blagden, Pastor of the Old South Church, Boston.

I have read with much pleasure and profit part of Dr. Smith's "Class Book of Anatomy,"—sufficient, I think, to warrant me in saying, that it will be highly useful in promoting the end for which it was designed, wherever it is used. Without, of course, being able to speak of it as an anatomist, I take pleasure in recommending it as highly adapted to impart instruction on that subject.

Very truly, yours, G. W. BLAGDEN.

From the Boston Christian Review (for March, 1837.)

The title of this book explains its object. It contains a minute, and, we presume, an accurate, account of the structure of the human body, illustrated by numerous plates. A general knowledge of the organization of the body, and of its physiology, ought to form a part of the education of every individual. It would have a favorable influence on the health, and it ought to awaken devout reverence towards the Author and Preserver of this wonderful mechanism.

Dr. Smith's book has been introduced into many academies and some of the higher class of seminaries, and it has passed to a second edition. These facts indicate that it has been found to be adapted to the purposes of education.

Extract from "Remarks on the Classical Education of Boys, by a Teacher," (Professor Cleaveland.)

If the pupil has leisure, as he undoubtedly will in the course of an education of seven or eight years, there are still other branches suited to his age, and which will be interesting to him;—and first I should recommend that he gain some knowledge of Anatomy. This will be highly interesting, and will be available knowledge as long as he lives. I observe with great pleasure that a text book on this subject has just been prepared by Dr. J. V. C. Smith, which ought to be adopted into all our schools.

It is a very valuable production, and in all things pre-eminently calculated to gain the confidence and respect of the public.—*Providence Journal.*

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ALGER'S MURRAY'S GRAMMAR; being an abridgment of Murray's English Grammar, with an Appendix, containing exercises in Orthography, in Parsing, in Syntax, and in Punctuation; designed for the younger classes of learners. By Lindley Murray. To which Questions are added, Punctuation, and the notes under Rules in Syntax copiously supplied from the author's large Grammar, being his own abridgment entire. Revised, prepared, and adapted to the use of the "English Exercises," by Israel Alger, Jr., A. M., formerly a teacher in Hawkins Street School, Boston. Improved stereotype edition.

As a cheap and compendious elementary work for general use, this is probably the best Grammar extant, which is indicated by its introduction into many Schools and Academies, in various sections of the United States. Though furnished at a moderate price, it is so copious, as, in most cases, to supersede the necessity of a larger work.

☞ By a vote of the School Committee, this work was introduced into all the Public Schools of the city of Boston.

ALGER'S MURRAY'S ENGLISH EXERCISES: consisting of Exercises in Parsing, instances of false Orthography, violations of the rules in Syntax, defects in Punctuation, and violation of the rules respecting perspicuous and accurate writing, with which the corresponding rules, notes, and observations, in Murray's Grammar are incorporated; also, References in Promiscuous Exercises to the Rules by which the errors are to be corrected. Revised, prepared and particularly adapted to the use of Schools, by Israel Alger, Jr., A. M. Improved stereotype edition.

Extract from the Preface.

It is believed that both teachers and pupils have labored under numerous and serious inconveniences, in relation to certain parts of these Exercises, for the want of those facilities which this volume is designed to supply. Those rules in Mr. Murray's Grammar which relate to the correction of each part of the Exercises in Orthography, Syntax, Punctuation and Rhetorical construction, have been introduced into this manual immediately preceding the Exercises to which they relate. The pupil being thus furnished with the principles by which he is to be governed in his corrections, may pursue his task with profit and pleasure. In this edition, more than forty 18mo. pages of matter have been added from Mr. Murray's Grammar.

ALGER'S PRONOUNCING INTRODUCTION TO MURRAY'S ENGLISH READER, in which accents are placed on the principal words, to give Walker's pronunciation. Handsomely printed, from stereotype plates.

ALGER'S PRONOUNCING ENGLISH READER: being Murray's Reader, accented by Israel Alger, Jr. Printed from handsome stereotype plates, on good paper, and neatly bound.

☞ These editions of Murray's books are in the highest repute of any other published in the United States, and are sold at a cheap price.

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BOSTON SCHOOL ATLAS. Embracing a Compendium of Geography. Containing seventeen Maps and Charts. Embellished with instructive Engravings. Eighth edition, handsomely printed, from new plates. One volume, quarto.

The Maps are all beautifully engraved and painted; and that of Massachusetts, Connecticut, and Rhode Island, contains the boundaries of every town in those states.

☞ Although this book was designed for the younger classes in schools, for which it is admirably calculated, yet its maps are so complete, its questions so full, and its summary of the science so happily executed, that, in the opinion of many, it contains all that is necessary for the pupil in our common schools.

From the Preface to the Sixth Edition.

The universal approbation and extensive patronage bestowed upon the former editions of the Boston School Atlas, has induced the publishers to present this edition with numerous improvements. The maps of the World, North America, United States, Europe, England, and Asia, have been more perfectly drawn, and re-engraved on steel; and the maps of Maine, of New Hampshire and Vermont, and of the Western States, also, on steel, have been added; and some improvements have been made in the elemental part.

It has been an object, in the revision of this edition, to keep the work, as much as possible, free from subjects liable to changes, and to make it a *permanent Geography*, which may hereafter continue to be used in classes without the inconvenience of essential variations in different editions.

From R. G. Parker, author of "Progressive Exercises in English Composition," and other popular works.

I have examined a copy of the Boston School Atlas, and have no hesitation in recommending it as the best introduction to the study of Geography that I have seen. The compiler has displayed much judgment in what he has *omitted*, as well as what he has selected; and has thereby presented to the public a neat manual of the elements of the science, unencumbered with useless matter and uninteresting detail. The mechanical execution of the work is neat and creditable, and I doubt not that its merits will shortly introduce it to general use. Respectfully yours,

R. G. PARKER.

From E. Bailey, Principal of the Young Ladies' School, Boston.

I was so well pleased with the plan and execution of the Boston School Atlas, that I introduced it into my school, soon after the first edition was published. I regard it as the best work for beginners in the study of Geography which has yet fallen under my observation; as such I would recommend it to the notice of parents and teachers.

From the Principal of one of the High Schools in Portland.

I have examined the Boston School Atlas, Elements of Geography, &c., and think it admirably adapted to beginners in the study of the several subjects treated on. It is what is wanted in all books for learners—*simple, philosophical, and practical.* I hope it will be used extensively.

Yours, respectfully, JAS. FURBISH.

I have perused your Boston School Atlas with much satisfaction. It seems to me to be what has been needed as an introduction to the study of Geography, and admirably adapted to that purpose.

Very respectfully, yours, &c. B. D. EMERSON.

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WALKER'S BOSTON SCHOOL DICTIONARY. Walker's Critical Pronouncing Dictionary, and Expositor of the English Language. Abridged for the use of Schools throughout the United States. To which is annexed, an Abridgment of WALKER'S KEY to the pronunciation of Greek, Latin and Scripture Proper Names. Boston stereotype edition.

☞ This handsome and correct edition, prepared for the Boston schools, with great care, has so long been used, that it is only necessary for the publisher to keep it in a respectable dress, to ensure it a general circulation.

The price of the work, neatly bound in leather, is reduced to 50 cts. single, $5,00 a dozen.

THE CLASSICAL READER. A Selection of Lessons in Prose and Verse, from the most esteemed English and American Writers. Intended for the use of the higher classes in Public and Private Seminaries. By Rev. F. W. P. Greenwood and G. B. Emerson, of Boston. Tenth stereotype edition.

This work is highly approved, as a *First Class Reader*, and has received many commendable notices from Public Journals throughout the United States, from which the following are selected.

From the Visiter and Telegraph, Richmond, Va.

This work is a valuable acquisition to our schools. It is a work purely national and modern. It has many valuable historical facts and anecdotes in relation to the early history, the character, manners, geography and scenery of our country. In the matter it contains, it is well adapted to the taste, feelings, and habits of the present age. It embodies many of the brightest and most sparkling gems of Irving, Webster, Everett, Jefferson, Channing, Sparks, Bryant, Percival, &c.

From the American Journal of Education.

We are happy to see another valuable addition to the list of reading books, —one which has been compiled with a strict regard to the tendency of the pieces it contains, and which bears the stamp of so high a standard of literary taste. In these respects the Classical Reader is highly creditable to its editors.

Extract from the North American Review.

The Classical Reader is selected from the very best authors, and the quantity from each, or the number of pieces of a similar character, by different authors, affords all that can be required for classes, and in sufficient variety, too, of manner, to facilitate greatly the formation of correct habits of reading, and a good taste. From each of those considerations, we give it our cordial recommendation.

☞ *The Publisher respectfully solicits the attention of Teachers, School Committees, and all interested in the cause of Education, to the foregoing list of School Books,—feeling confident that an examination of the works will lead to a conviction of their merits,—copies of which will be furnished for this purpose, without charge.*

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